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No. 1

Conservation of India's Natural Resources*

By

S. M. TAHIR RIZVI,

B.A., PH.D., M.A., F.R.G.S., F.R.MET.S.

Ladies and Gentlemen,

I thank you most heartily for the honour you have done me by electing me to preside over the deliberations of the Geography and Geodesy Section of the Indian Science Congress of this session. I am conscious of the great responsibility placed on my shoulders; but, counting upon your kind co-operation and forbearance, I shall try my best to fulfil the task in as best a manner as could be possible.

INTRODUCTION

Few problems in India are of more vital importance than the conservation of the natural resources of the country on a planned basis. To-day, public consciousness needs more than at any other time of Indian history to be rightly educated as to the existence and utilization of abundant natural resources of the country. I have, therefore, selected the conservation of India's natural resources as the subject of my address as it is a subject of general interest as well as of vital importance to our nation.

Whereas the growth, greatness and survival of a nation depend largely on the natural resources of the country, their conservation seeks to insure to society the maximum benefit from their use. Thus conservation of natural resources such as soil, forests, water and minerals, without which the very existence of a nation

* Presidential Address at the Section of Geography and Geodesy, Indian Science Congress, Benares 1941.

may be at stake, should, therefore, unquestionably be one of the most important matters for the consideration of those who are entrusted with the responsibility of formulating programmes of national reconstruction.

Conservation of natural resources is a timely field of action in India. The growth of population in this sub-continent has been accompanied by an unprecedented destruction of the natural landscape. Moreover as the country awakens politically and the limits of its resources and the character of its need begin to appear more fully, the necessity for greater care in the utilization and renewal of resources becomes imperative indeed. The movement is a timely one being in line with a world-wide concern regarding the material bases of national well-being.

There is no doubt that conservation is a field of vast national importance and of such magnitude and range as to demand the co-operation of nearly everyone. Contributions to its theory and practice may be made by the layman and the scientist, by the philosopher and the practical man of affairs, by the social scientist and the natural scientist. In one way or another, each of the natural and social sciences can give, and, indeed, is giving some assistance, directly or indirectly. The scientific geography though still in its infancy in India is contributing to the field of conservation both theoretically and practically. Studies in systematic and regional geography are greatly helping to build up our knowledge of our natural resources and the problems arising from their exploitation. Geographers are also taking an active part in the practical application of their view-point and techniques to problems facing the nation. Moreover, they are imparting useful knowledge of the principles and practices of conservation in the colleges, and in a small measure at elementary and secondary schools. The rising generation is, therefore, learning largely through geography teachers and text-books about the aims and practices of conservation. However, it is not meant, in any sense, to imply that teaching in this field is exclusively the function of geography.

As the subject selected by me is a very wide one it would not be possible for me to discuss it fully in the short time at my disposal. I have, therefore, limited my address to three aspects of the problem, that is to say, conservation of soils, forests and water resources.

SOIL

The soil of a nation is its most material heritage. It nurtures the ever-flowing stream of vegetation from which men and their

animals derive their sustenance. The preponderance of the world's organic raw-materials as well as its food supplies arise from soils through the practice of agriculture. The great civilizations of the centuries have rested fundamentally upon uncountable millions of fields planted and tended by man.

The civilization of this country has been and is based upon its soil resources and great agricultural industries. Our country taken as a whole possesses such a combination of soils and climates that it suits admirably to agriculture and no less than nine-tenths of the population of India to-day is engaged, directly or indirectly, in agricultural pursuits. Soils are subject to certain changes when cultivated or pastured. Change in itself is not a critical matter since eternal change is a fundamental law, for, were this not true, it is doubtful if man could have survived. The critical aspects arise when changes in soils that are subject to human manipulation are left to take a degenerative course, or are improperly directed, and when known means of maintaining the soils near their virgin level or raising them to higher levels of productivity are not employed.

These critical aspects obtain rather generally in India. At the end of several centuries of agriculture and pastoralism, the soils in India are in a lower state of fertility than our scientific and practical knowledge should tolerate. Especially serious is the fact that some soil areas have so seriously deteriorated that their early reclamation will be extremely difficult and costly, if not nearly impossible. This is particularly true of the gross physical destruction of the soil body occasioned by erosion. More subtle but almost equally serious is the state of chemical, physical and biologic degradation into which we have allowed our soils to drift. The causes are many. We have not fully appreciated either the limitations or capabilities of our soils. They were and are looked upon much as a mine, as simply possessing a store of plant food: when these had been extracted there was little we could do except abandon the land until it somehow recuperated. Moreover, since the keynote of Indian agriculture has been primarily self-maintenance, systems of cropping were so shaped as to yield the maximum results regardless of the tolls on the soil. Whatever the causes the general results are equally deplorable.

SOIL EROSION AND ITS CAUSES

Within the last few years we have learnt that erosion, far from being a harmless or completely beneficial process in all its manifestations, is a living, constant menace to our own security and the security of posterity. We have learnt that the process

does not remain at geologic norms when human factors intervene in the natural order of dynamics pertaining to the earth's surface. We know definitely that man's misguided use of the land has accelerated this ancient earth-process until it has overwhelmed enormous areas of once fertile land and impoverished even greater areas. In the light of this knowledge erosion becomes a matter of concern to everyone; since it constitutes a threat to the principal factor in our country's security—our indispensable agricultural lands.

Accelerated erosion is the result of conflict between man and nature—of man's necessary interference with natural processes of land stabilisation in order to provide himself with the necessities of existence. Under a blanket of vegetation, nature protects the soil from the erosive forces of wind and rain and her protection is almost complete. Soil losses under natural conditions of vegetation cover are negligible—so small, in fact, that normal processes of soil building are generally adequate to compensate for them.

Faced with the problems of existence, man strips away the protective cover of vegetation, and thus rudely interferes with nature's balance. Soil is exposed to winds and rain, and rates of erosion are increased almost enormously. Cultivation still further exposes the soil to the cutting force of wind and flowing water, again accelerating the rates of wastage. In the one instance—under natural vegetative conditions—therefore, erosion is normal or geologic; in the other—under cultural practice—the process is speeded to abnormally destructive rates. Soil erosion has thus become a world-wide problem owing to the way in which ploughing and grazing have destroyed the plant cover which Nature originally provided to protect the earth's cover.

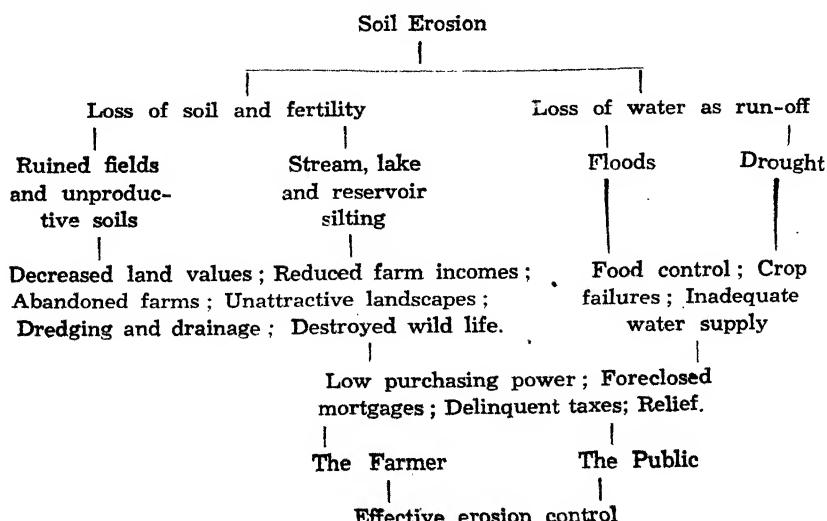
TYPES OF EROSION

There are broadly speaking three types of erosion: sheet erosion, gully erosion and wind erosion.

The first is the most wide-spread and dangerous, being the principal agency of soil impairment, for it can do great damage before it becomes apparent to the farmer. Sheet erosion characteristically proceeds so slowly that farmers themselves generally have not understood it and, accordingly, have given little attention to its effects until out-croppings of infertile sub-soils or bed-rock appear over their sloping fields. The process involves removal of thin sheets of soil over entire extent of unprotected areas with every rain heavy enough to cause water to flow across the slopes.

The first effect which often goes unnoticed, is the removal of the finer soil particles in suspension, leaving the coarser particles behind. These finer parts of the soil are valuable because they help to bind the soil into crumbs. The capacity of the soil to retain moisture and soluble plant food depends largely upon this crumb structure. If the finer particles are lost by sheet erosion the soil deteriorates. In extreme cases the whole of the top soil is removed, bodily, leaving behind only an infertile sub-soil of clay or gravel. Sheet erosion is common throughout India except in areas irrigated by canal or well, but is of course more serious on all sloping land.

Gully erosion is much more obvious and it is easy enough to see and understand the deadly malignancy of it. This type of land devastation frequently follows after sheet erosion as a later stage of deterioration. When there is not enough vegetation to impede the run off of storm water, the proportion of rain not absorbed by the soil finds its way downhill in a series of small torrents. A vicious circle is set up, because each channel is cut wider and deeper by every succeeding downpour, and the torrent tears soil from the sides and bed of the gully. Loss of soil is increased by the cutting back of each branch gully into the higher ground behind. Deeply gullied "bad lands" are to be seen in many parts of India whenever the level of the land surface is at all high above the bed level of nearby rivers.



(Chart showing how soil erosion affects the general public as well as the farmer.)

The Jumna basin provides one of the finest examples of gully or ravine formation in the world. In many parts the vegetation on the neighbouring lands after centuries of abuse is of a very poor description and the rainfall flows away with great rapidity thereby increasing the volume and the violence of the torrents and leaving their beds dry after a few hours of the storm. The accumulated effect of this flood and scouring in a hard Kanker soil has resulted in the banks of the Jumna and the Chambal being violently eroded during the last few hundred years with a corresponding sinking of the water level.

A rough calculation has shown that the total soil erosion of the Jumna-Chambal basin is equivalent to the removal of 12 cusecs or $\frac{1}{2}$ ton of soil per second day and night without stopping for the last 1,000 years.

Both sheet and gully erosion are caused by water action but another form of erosion results from wind action. Open treeless plains of dry light soil are particularly susceptible when the natural grass cover is destroyed by ploughing or heavy grazing, for the exposed soil can then be whipped up and carried away by strong winds.

Ground thus disturbed develops a peculiar topography of low hummocky sand-hills on top of which deep-rooted bushes survive after all other vegetation has given up the unequal struggle. Actually India as a whole does not suffer from wind erosion to the extent that has occurred in the so-called "dust bowl" of the middle Southern States of the United States of America, or in the inland livestock ranches of Australia or along the southern fringe of the Sahara. But in certain restricted areas in India it is a definite menace, for instance, just north of Campbellpur in Attock district and along the Delhi-Lahore road near Doraha.

WIDE-SPREAD EFFECTS OF EROSION

The harmful effect of these three forms of soil erosion go far beyond the removal of the valuable top-soil on which plants depend for their nourishment. One direct effect is of course gradual decline in crop yields which more than off-sets any gains brought about by seed selection and manuring. The direct effect in pastures and grazing lands is to reduce the capacity of land for carrying livestock, for good pasture may carry a cow per every two acres, but the eroded pasture land may not keep a cow properly on ten acres.

Erosion also has indirect results, of which the most important for us in India is the dumping of large quantities of sand in the river beds so that the bed must inevitably be raised and thus aggravate the effect of floods.

Another effect is to increase the severity of the intervening drought periods. This is because each small stream in the foot-hills discharges perhaps 80 or even 90 per cent of heavy storms within an hour or so, and only a very small part of the rain soaks in the bare ground.

Apart from the rivers therefore the level of the water-table underground is apt to shrink because the amount of percolation or seepage through the soil into the underlying rocks and sub-soil is less. Springs and wells are fed by reserves of water stored underground, but these reserves dwindle because eroded soil will not allow rain to penetrate underground, so that wells dry up, springs are reduced to a trickle, and rivers that once flowed all the year round now fail in the dry period.

Aside from the destruction above-mentioned, erosion carries with it consequences of vast importance to the permanence of investments of large sums of money in navigation, power, municipal water supply and irrigation developments.

DEFORESTATION AND SOIL EROSION

It is admitted by all authorities on erosion that one of the greatest calamities which have overtaken mankind has been the destruction of the forest and the consequent erosion of the land surface. This has already destroyed the fertility of many lands and is at the present day exercising a great influence on the destiny of the people. Deforestation and soil erosion not only intensify floods and reduce the cold weather discharges of surplus streams but they threaten the sub-soil water supply and impoverish the soil and reduce the output of agriculture. In fact, these two demons threaten the very basis of civilization and of human life.

Erosion results from the misuse of the surface covering of the earth, whether it be by the destruction of the forest which covered it, by the misuse of arable or pasture land, by bad methods of cultivation, by burning or by over-grazing.

There is sufficient evidence to show that India is faced with the very grave danger of her river catchments being denuded to such an extent as to increase floods during the periods of heavy rainfall, decrease river supplies for irrigation and navigation during the dry season, increase siltation of the rivers, and throw large areas out of cultivation.

America is now fully alive to the disaster which threatens her and has even formed a special department of engineers to deal with erosion while her foresters are actively fighting deforestation.

There are many indications that in parts of India conditions are, at least, as bad and, sometimes, worse than they are in America. For instance, the Ganges carries to the sea eight times the quantity of silt carried by the Mississippi and that from a catchment area less than one-third the size.

It is not without significance that the highest recorded flood in the Ganges occurred in 1924 and the lowest record of winter discharge occurred in 1929. Records of the Ganges for over 100 years are available and this period is long enough to exclude all seasonal cycles.

AMERICAN RESEARCH

American research has found that during the years 1935-37, the rate of run-off from completely denuded lands, such as is only too common on the banks of some of our rivers, such as the Jumna and the Chambal, is twenty times greater than it is from preserved forests. During one month of the flood season in Southern California a watershed, which had been burnt out 4 years previously, was denuded of 120,000 cubic yards of top soil or a depth of 1.4 inches per square mile. On a similar watershed burnt out 19 years previously, the denudation rate was one-tenth of this while in a watershed fully protected for the last fifty years the same rainfall only gave a denudation rate of one-thirtieth of this.

The fertility of the soil lies in its top crust and the removal of 1.5 inches of the surface soil which Nature takes a long time to create, amounts almost to a disaster. The unproductiveness of newly exposed sub-soil is well known and one might almost say that once the surface has been destroyed, fertility has gone for ever as far as the present generation is concerned. It seems quite reasonable to suppose that one of the most important factors contributing to the low crop yield in India is erosion by wind due to the absence of wind breaks.

EXAMPLES OF DAMAGE

It is generally known that there are extensive waste and ravine lands in Agra, Muttra, Etawah and the adjoining districts. The ravines of the Jumna and the Chambal river form a practically compact mass the extreme length of which is 70 miles and the

width about 13 miles in the centre. It is estimated that in the Etawah district alone there are about 120,000 acres of ravine land and there are large ravine areas in Agra, Muttra, Jalaun and other districts.

THE DESCRIPTION OF RAVINES

The banks of the Jumna and its tributaries are now so completely drained that the greater part of the area has become almost destitute of vegetation. Cultivation beyond this desert belt is precarious even in years of normal rainfall and the presence of these ravines renders irrigation impossible. Throughout the whole extension of this ravine land no water is to be found except in deep wells and in the main rivers. The dry belt is increasing in extent, as the ravines eat into the flat lands at the heads every year. With the hardening effect of the tread of cattle and rapid drainage the monsoon rains penetrate to a depth of only a few inches and this quickly dries up leaving a soil almost destitute of moisture down to the water table 100 feet or more below. It has been found that occasional scattered trees now found are of great age which have continued to reproduce themselves by copice shoots and their root-systems have kept pace with the sinking of the water level, drawing up their necessary moisture from great depths. Natural reproduction invariably dies down as soon as the rains cease. The natural vegetation of the ravine land has been destroyed by uncontrolled cultivation wherever the soil is fit for this, and by uncontrolled grazing, reckless destruction and by fires elsewhere. Large areas are now almost treeless but the original natural vegetation was undoubtedly forest and is still forest except in Kanker and Usar soils. The vegetation consists of small trees, thorny bushes and grass.

THE PANJAB SIWALIKS

Some of the worst erosion is evident in the Panjab Siwaliks, a range of hills skirting the Himalayas where the hill grazier has accompanied or followed the wood-cutter and effectively denuded the soil of its protective plant cover. In many places damage is not confined to the eroded slopes, further destruction being caused by torrents (chos) formed by gully erosion, that sweep down the slopes during the monsoon. The cho is characterized by the steepness of its gradient and the violence and irregularity of its discharge. The torrent carries much suspended material which is deposited on the less steep lower slopes in a characteristic detrital cone which continually increases in radius and width. The chos

debouching on to the cultivated sandy plains silt up the original drainage channels formed when hill erosion started, and the floods are forced out over wide areas. The floods subside as suddenly as they start, and all the water is lost to the land.

There is evidence that a hundred years ago the chos ran between well-defined banks, and in some places perennial streams that could be used for irrigation issued from the hills. To-day, floods are the only source of water. Much of the subsequent erosion has been due to intensified exploitation that occurred when British rule secured some measure of prosperity and security. Reclamation might possibly be effected by closure of the land so that first grass, and then forest, could be re-established, but all the land is required to support the people, who have the right to use it, and the authorities have a natural aversion to interfering with jealously held rights. A drastic reduction in the surplus grazing animals is indispensable before any conservation programme can become effective.

NECESSITY FOR CONTROL

Accelerated soil erosion and its control presents the country with a physical land crisis of enormous importance to the continuing welfare of agriculture in particular and the entire social structure in general. Moreover, beyond the most acute crisis of the whole land problem, there exists the physical fact that there can be no permanent cure of floods or prevention of stream and reservoir silting until run-off is better controlled, all the way from the crust of ridges down across the watersheds where floods originate and silt loads are picked up, on to the very channelways of streams, which have limitations upon their carrying capacity.

Control of erosion is the first and the most essential step in the direction of correct land utilization. It must be performed if the country is to avoid early arrival at an inconceivably bad land situation. The United States of America and the Union of South Africa have reached the same conclusion and are now engaged in a fight against erosion in their country. The Italian Government is carrying out an enormous land reclamation and conservation programme. Japan for many years has been spending many times the value of numerous critically eroding areas in order to protect indispensable valley lands from the erosional debris issuing from such sore spots. There is no reason to assume that India can better afford to neglect this gigantic problem of waning soil productivity than any other country.

FORESTS

One of the most valuable assets of India is her forests both from the point of view of material wealth they represent and their incalculable value to livestock and agriculture, providing food and giving natural protection against floods and dust storms. Their beneficial influence on climate, on the conservation of the water supply, on the flow of streams and rivers and the prevention of the erosion of soil needs no emphasis.

To realize how important it is to retain the natural protection afforded by forest, one has only to look round at other countries and to see how large areas of land unsuited for permanent cultivation which were alienated from forest and made into farms, have, now, been abandoned to waste and desolation and in others how forest denudation has led to flooding and dust storms which have brought wide-spread destruction and misery in their trail.

With the steady growth year by year of knowledge of the importance of the part played by forests in the prosperity of countries, particularly an agricultural land like India, the problem has become of national interest.

The character of the forests in India is largely governed by rainfall and elevation. Where the rainfall is heavy ever-green forests are found. Under a less copious rainfall deciduous forests appear, containing teak, sal, and a great variety of other valuable trees. Under a still smaller rainfall the vegetation becomes sparse, containing acacias, tamarind, etc. In the Himalayas, sub-tropical to arctic conditions are found, and the forests contain according to elevation, pines, firs, deodars, oaks, chestnuts, etc. It has been the experience of all countries that the natural processes of growth and reproduction by which forests are kept alive are incapable of keeping pace with man's destructiveness, hence it is necessary to take special measures in the ultimate interests of the country to preserve its forests from reckless destruction.

FOREST INFLUENCES

If you read history, you are bound to believe in the prosperity of the ancient kingdoms, and if you compare their ancient grandeur with their present decay, and their ancient wealth with the amount produced to-day, you can only be driven to one conclusion, and that is that the present decay of these countries is very largely due to the deterioration of the moisture that lies in the earth. Now, just imagine

for a moment, what has happened to Persia. Take the example of the palace of the King of Kings, Darius, who at one time reigned practically over the whole eastern world. Can you imagine a man occupying his position, building his palace in the desert? But to-day, if you see the ruins of the palace of Darius in Susa, they stand in an uninhabited wilderness. Mesopotamia, which for generations produced all the revenues of Persia by which that country was able to wage wars against the Romans, has degenerated into a dreary waste and the hanging gardens of Babylon are a rubbish heap. No doubt the degradation of Babylon was partly due to the destruction of the irrigation works by the invasion of the Mongols, but already at that time, the irrigation system of Mesopotamia was in a state of decay on account of the destruction of the forests on the hills, and the bad regime of the Tigris and Euphrates which supplied the water for the finest irrigation system in the world, a vast system with which the Panjab at the present day cannot compare. The same history has been repeated all over the world. In Greece, Anatolia and Spain, the destruction of the forests has seriously interfered with their climate, with their cultivation, and with the moisture content of their soil. So much has this been the case in ancient history that it has been stated that deforestation, by the lowering of the moisture content of the soil, thus decreasing the water supplies of the country, has done more damage than any war, and has resulted in the destruction of the greatest empires.

UTILITY OF FORESTS

The history of modern civilization is founded upon wood. Despite the increased use of iron and steel and their replacement of wood for many purposes it is a proved fact that the consumption of wood per head of population has been steadily increasing, unless limited by supplies, in all countries in proportion as the material prosperity of the people has increased. In Europe and America the consumption of wood per capita is over 20 cubic feet; in India it is under 2 cubic feet. Prosperity involves increased wood consumption and to supply the ever-growing requirements of the people is one of the most important of the functions of the forests. The great mass of the population of India are not townsmen but agriculturists who live in the country, and those of them who are fortunate enough to live in the vicinities of forests know that the forests mean to them much more than the mere production of timber and that the success of their cultivation of field crops is intimately bound up with the existence of the forests. A supply

of firewood is one of the most essential needs of the people, and where there are no forests from which firewood can be obtained the people have been driven to burn the cowdung which should have been used to fertilize their fields. There are innumerable cases where the destruction of forests have led to the burning of cowdung with serious adverse results on the cultivation of crops. But apart from yielding firewood and poles for building houses the forests yield many other kinds of produce which the agriculturist wants. They yield him timber for making his ploughs and other agricultural implements, bamboos for fencing and other purposes, thatching grass, grazing for his cattle, edible fruits and flowers which help him to live more especially in times of famine, fibres for making ropes, medicines for the sick; and many other articles.

There are numerous indirect benefits conferred by forests whose importance is not readily understood.

Firstly, forests increase the relative humidity of the air, reduce evaporation, and maintain a more continuous degree of moisture in the soil. They also tend to increase precipitation of moisture. These effects are important from the agricultural point of view in a hot dry climate such as is prevalent over most of India.

Secondly, forests assist in regulating the water supply by reducing the violence of floods and by rendering the flow of water in rivers more continuous. They further assist in preventing erosion. On denuded soils the rainfall rushes off the surface in torrents which gather in volume and sweep away the fertile top soil of the land. On forest covered areas the rainwater is held up by the crowns and roots of the trees and the more spongy forest soil, with the result that it percolates more slowly into the ground and emerges in the form of springs which supply the rivers more continuously with water. In areas where deforestation has been rapidly proceeding many of the streams which used to run all the year round have now dried up and this has had a bad effect on field crop cultivation. Innumerable examples of the serious effects of the forest destruction on the fertility of the soil and water supply could be quoted from all over India. This valuable effect which forests have in reducing the effect of erosion and floods is not, however, confined to the areas in which the forests are situated. The disastrous floods in the plains have been due to the destruction of the forests in the river watershed. Such floods tend to get greater and greater each year as the destruction of forests in the hill areas in which its tributaries have their source proceeds and unless this progressive destruction of forests is checked the time may one day come when still more disastrous effects of flood will be experienced.

Thirdly, forests reduce the velocity of wind and protect adjoining fields against hot dry winds. They afford shelter to cattle and generally reduce the temperature of the air and render the climate more equable.

Fourthly, forests increase the artistic beauty of the country and exercise a restful effect on the human mind, thus assisting in furthering the happiness of the people.

FOREST AND FLOODS

It has been often stated that a forest cover in a drainage basin materially reduces floods but forested areas are not free from the hazard of flood damage. Although the effect of forests upon run-off has often been overstated their effectiveness should not be depreciated.

Adequate flood protection is largely dependent upon engineering structures but the forest cover should be considered as a supplementary protective measure. A closely forested area with its absorptive leaf-litter delays run-off somewhat and gives greater seasonal uniformity to the discharge of the streams. This slight retardation of run-off may serve to reduce floods provided the subsequent rains are delayed a sufficient length of time to permit the lowering of the water table and a drying out of the litter. If the absorptive capacity of both the litter and the soil is reduced because of saturation heavy downpours of rain will cause floods. Probably the most important effect of the forest cover is not in its effect upon surface run-off but upon its protection of the soil, which in rugged areas is susceptible of removal, and when both the forest cover and the absorptive topsoil have been removed, all rains, no matter what their spacing, yield rapid run-off. These indirect results are of major importance in the prevention of floods and in the maintenance of reservoir capacity whether the reservoirs be used for flood prevention or for other purposes.

DEFORESTATION IN INDIA

There can be little doubt that there were forests stretched all over the greater part of India. In the Vedas, the earliest religious writings of the Hindus, in the epic poems of the Ramayan and the Mahabharat, references are made to dark, dense forest areas situated in the Gangetic Plain, now a vast expanse of cultivation and for a thousand miles or more devoid of forest growth. Similarly the records of the wanderings of Chinese pilgrims (about 600 B.C.) frequently speak of miles and miles of very dense forests

in the now almost treeless districts of Gorakhpur and Western Bengal. As late as the sixteenth century the Moghal Emperor Baber hunted tiger and other big animals of the forests along the Jumna river, in areas which have now become barren ravine deserts of stunted thorny bushes.

In the turbulent days of early Indian history with the rise and fall of dynasties and powers, the areas of forest fluctuated, shrinking to make place for cultivation with the advent of a strong ruler, increasing again with the collapse of central power, or when wars, pestilence and famines reduced the density and pressure of population. Thus we still find ruined and long forgotten cities in some parts of Indian forests. With the advent of the British rule in India, resulting in a great increase of population, with the attendant demand for timber for agricultural implements, constructional purposes, etc., a fierce onslaught was commenced on the forest areas and by the middle of the nineteenth century all traces of primaeval forest in the Gangetic Plain disappear except in the mountainous regions. Thus the destruction of the forest area, or rather the diminution in the area of the forests within the boundaries of India, has been going on at a very great rate during the last 150 years. To give you an instance, when the Emperor Jehangir built the castle of Nurpur for his Queen, Nur Jehan, the Light of the World, he writes in his memories that forest was so thick that a bird could hardly spread its wings. But if you go to that place to-day, you will see nothing but a denuded hill country, with hardly more than a few tufts of grass and thorn bush on which a few goats eke out a miserable existence. All that has happened in a period of not more than three hundred years; in that time the dense forest which clothed the outer Himalayas has been reduced to a negligible amount.

Due to the reckless extermination of forests by man or through excessive grazing, fires or over-cultivation, the area covered by forests in the United Provinces has been reduced to 4 per cent of the total area of the province and is confined almost entirely to the hills and sub-montane region. This in itself by all standards is inadequate to meet the diverse demands of a progressive country as it has been estimated that about 20 per cent of the area of a country should be covered by forests.

NECESSITY OF FOREST PROTECTION

There are two main reasons why such protection is necessary. Firstly, forests require protection from man. It is a common failing in human nature that whenever any product is found in abundance

its use is abused without thought for the future. The steady destruction of forests which has taken place in the old and new world is a striking example of this attitude on the part of man. The great Indian epics tell of the mighty forests which used to exist in the Gangetic Plain. At the present day there are only remnants of forests left which are confined to the hilly tracts of the country, and over most of the plains the people are put to hardships as they cannot get the forest produce on the supply of which the success of their cultivation depends. The reclamation of forest land by bringing it under the plough is a sign of agricultural progress as the people must have food to live and the greater the area under cultivation the better. But there are large areas of forest land which have been cleared for cultivation, which should never have been cleared as the soil is poor and incapable of supporting field crops year after year. Good forests can be grown on land which is poor from the agricultural point of view, and on such poor soils forests should be retained because they are more valuable than field crops. The practice of shifting cultivation under which forest areas are cleared and burnt, cultivated for two or three years, and then abandoned, has been responsible for destroying large areas of forests.

Apart from the clearing of forest land for purposes of cultivation there is another factor which has been responsible for the destruction of numerous forest areas in the country, and that is that, left to himself the villager takes no care of the forests. He hacks down the trees indiscriminately and allows his cattle and goats to graze all over the forest thereby preventing any new trees from growing up to take the place of those he has removed. In how many thousands of villages can you see areas of barren waste land which formerly were covered with useful forest and which now do not yield even a scanty supply of grass? It is thus sufficiently evident that forests must be protected from the thoughtless acts of ignorant villagers who would otherwise destroy the forests with dire consequences for future generations.

FOREST CONSERVATION

Forest conservation is a field of vast significance in Indian life. The services which forest can perform are numerous and their influence far-reaching. Moreover, the renewable character of forest makes for a very practical phase of conservation. With sufficient fore-thought, the country's resources can be kept at a level more nearly commensurate with its needs for wood products and other forest services, and, at the same time, much of the land

which is now unproductive but suited to growing trees may be put to use.

WATER RESOURCES

One cannot imagine man separated from water any more than one can imagine him separated from land. Water is an essential part of his being. He uses it in innumerable ways and because in areas of dense population he has been favoured with it, frequently he spends it recklessly, thinks of it as he thinks of air as an unlimited requisite of existence, and gives little heed to its value. In drier regions water is held of great value, and stringent laws governing its use are formulated.

The place of water in the lives of people in arid lands may be realized by the frequent rain ceremonies of the Hopi Indians and by the repeated references in the religious literatures of desert peoples, as the Bible and the Koran, to water as a blessing and to paradise as a place where there is abundant water.

Our water comes from precipitation, and the average rainfall for India is about 42 inches per year. This average will lead us easily to the total amount of water received by the country in one year but it tells nothing about the distribution.

The rainfall varies from almost nothing in the desert tracts of Rajputana to over 100 inches in the outer Himalaya and is profoundly affected by elevation and the distance from the sea. Most of the annual rainfall takes place in July, August and September during the summer monsoon; April and May are dry and intensely hot; the autumn is dry and in winter very little rain falls. Towards the north-west the rainfall decreases and the Punjab, formerly desert, is now irrigated by a network of canals which take their origin from the rivers of the Himalayas.

In regions of scant water-supply, conflicts are likely to arise over water rights, and frequently in densely settled regions there must be a choice between its various uses. One arrangement of the uses of water in order of influence or importance is as follows:—

1. Atmospheric moisture indispensable to organic life.
2. Drinking water for man.
3. Water used in agriculture and animal husbandry.
4. Water as a habitat of fish and sea-food.
5. Water used for generation of power.
6. Water used for mechanical and chemical processes in industry.

7. Water as a means for transportation.
8. Water as a medium for the removal and purification of waste.
9. Water as a recreational asset.
10. Water as a determinant of political boundaries.
11. Water used as ice.

India, for the manifold uses of water, must depend upon its rainfall. The 42 inches of annual rainfall cannot suffice for all of them. About one-half of the rainfall is evaporated and goes back into the atmosphere as water vapour, about one-third of it forms the run-off, draining by streams and rivers to the sea. This is the visible water-supply, and the greater percentage of the use in the above list arises from this portion of the water. One-sixth of the rainfall sinks into the ground and forms ground water; this is a less well-known but very important reservoir of water which acts as a stabilizer of lake levels and stream flow and a source of water-supply for the plant growth.

The problem of the manipulation of the enormous amount of water which falls in India varies with the humidity or the aridity of the area. Evaporation, run-off and ground soakage are not uniform, and unwise practices may increase run-off to a danger point and destroy the balance set up by natural agencies. Among the many problems of water are the control of floods which, for example, have caused great losses of life and property in the eastern Gangetic plain; the control of low water stages which have hindered navigation, as on the Ganges and the Brahmaputra rivers, or have caused losses of crops; its use for navigation, power, water-supply for cities and towns, and the removal of refuse from houses and factories; and erosive tendencies of rain and streams; the silting of streams and consequent deposition when stream flow decreases; its use for irrigation; the maintenance of the ground water-supply and the stabilization of the water table, and the use of water as a recreational appeal. A water policy of the country should be so established as to yield the greatest benefit possible from our water resources and be so regulated as to serve the greatest need. At all events, one needs take the stand that water is a highly valuable source, too precious to be wasted.

IMPORTANCE OF WATER FOR DOMESTIC PURPOSES

Water is one of mankind's most essential needs. Primitive settlements were located around springs and water courses, and when the water failed the people were driven from their homes.

Palmyra, once a city of possibly more than 150,000 people, vying with Damascus for the trade between Egypt and Babylon and reaching great prominence under the reign of Queen Zenobia, consists to-day of a few ruins in a desert landscape while Damascus still exists. Both were oasis cities, but the drying up of the oasis at Palmyra spelled its doom. Later people learnt how to build aqueducts and transport water from distant springs and rivers. When gold was discovered in the Australian desert in 1892 and the towns of Kalgoorlie and Coolgardie were founded, the district was practically waterless. For a while the railway transported water to the towns at a cost of about Rs. 15,000 a day. In 1903, a water line was completed from the Darling Range, 350 miles away, and a delivery of 8,000,000 gallons daily resulted. So long are the pipes that they contain a month's supply of water; in other words, the water takes one month in travelling from Mundaring to Kalgoorlie.

Residents of the Indo-Gangetic Plain have not really appreciated the value of water as the dwellers in more arid regions have. The idea that there was an ample supply has been passed on from generation to generation. To-day it is necessary to combat the idea and treat water as a natural resource of limited though perhaps inexhaustible amount which must be conserved so that the supply at anyone time may be adequate for our needs and particularly so that its misuse may not be a burden to future generations.

SOURCES OF WATER-SUPPLY

Cities and towns in India obtain their water-supply from many sources—Lakes, tanks, wells, springs, tube-wells, and streams. Most rural towns and many urban localities depend on ground water for their domestic supply, and this comes to them in part through springs but largely through ordinary wells. In every rainfall where there is a surface mantle over the rocks a certain percentage of the water is absorbed by the soil (estimated average about 16%). This forms ground water. Its upper surface is known as the water table. The amount of ground water is much greater than is commonly supposed. It has been said that there is enough water under ground so that, if it were brought to the surface, it would form a layer probably 500 to 1,000 feet deep. The depth of the water table varies; in swamps the water table reaches to the surface, and in arid areas it may lie a hundred feet below the surface. Frequently, in the Gangetic Plain, water is struck before one digs to 25-30 ft. The water-table depth in any single

locality varies with the rainfall. A long period of drought takes a serious toll of the ground water, and the water table may be so lowered that it falls below the level of the well bottoms and the wells become dry. If the drain is not heavy the water table is generally brought back to its normal level by succeeding falls of rain. An extended drought, however, may bring serious damage by killing off the vegetable cover and subjecting the soil to wind and later rain erosion. In some localities, the water table has been lowered beyond the level of efficiency by stripping the vegetation cover, as in excessive deforestation, and in the processes of extensive cultivation, soil erosion, and ditching. For example, it is estimated somewhat roughly that the water-table over large areas in India has been lowered by 10 to 20 feet by these methods. As an extreme example may be quoted the serious reduction in the base level of the Jumna River where flooding and scouring has lowered its bed at Etawah sixty feet in the last five centuries with a corresponding fall in the spring level. The cold weather level of the river is often 120—200 feet below the surrounding country. The effect of this upon the ground water supplies is obvious.

IRRIGATION

The arid and semi-arid regions of India like Sind, Rajaputana and the south-west Panjab which are practically rainless have largely been rendered habitable and their latent resources made available to man by the use of water for live-stock subsistence and irrigation. Water, a vital resource in any environment, assumes extra-ordinary significance in regions of less rainfall. In the arid and semi-arid regions of India, the conservancy of water becomes of permanent importance.

The chief characteristics of the Indian rainfall are its unequal distribution throughout the country, seasonal irregularity of precipitation and liability to failure or partial deficiency in many tracts. But, within individual tracts, remarkably wide variations in total annual rainfall are found. Such tracts include practically the whole of the Panjab and North-West Frontier Province, the United Provinces except the sub-montane regions, Sind, a large portion of Bihar, most of the Madras and Bombay Presidencies, omitting the coastal belts, and portions of the Central Provinces. The concentration of the principal rainfall in less than a third of the year places a very definite limit on the agriculture of the country. Thus our agriculture cannot afford to depend exclusively on rainfall and it becomes necessary to provide the agriculturist with suitable irrigation facilities.

The advantages of irrigation are numerous, the principal one being an increase in the yield of crops, the successful introduction of a stable agriculture in arid and precarious tracts, protection from and insurance against famines and scarcity and larger railway profits in agricultural provinces. The Indian canal system is by far the largest in the world. Of the total cultivated area of 280 million acres, no less than 60 million are irrigated from one source or another.

GREATER DEMAND FOR WATER

In view of the rapid increase in India's population and consequent increase of pressure on land the demand for more water for irrigation and for better distribution of the existing supplies becomes annually more insistent.

WATER POWER AND ITS CONSERVATION

Importance of Power

Mechanical power is the heart of modern civilization. Until means of mechanical power were developed man was unable to gain any definite control over the elements. The power-driven machine and its accompanying division of labour have almost entirely replaced the self-reliant workman of former decades. Man's welfare and comfort depend upon a continued and uninterrupted supply of power. Power is as essential a part of the necessities of modern life as are food, clothing, and homes. Indeed, without the use of mechanical power man's necessities and luxuries would be limited to the products of his immediate locale. The use of power allows him to live where he desires, to have his wants carried to his home, and to be transported to and from his work.

SOURCES OF POWER.

The principal sources of power available in India are coal, wood-fuel, oil, wind and water. Coal is India's most important mineral and India produces more coal than any other part of the British Empire with the exception of the United Kingdom. Most of the coal raised in India comes from Bengal, Bihar and Orissa (the Gondwana coal-fields). Outside these provinces, coal is obtained from Hyderabad State, Central Provinces, Assam, the Panjab and Baluchistan. Rajputana, Bikaner and Central India also contribute a small amount to the total coal supplies of India. Indian coal is thus very unevenly distributed, the deficiency being especially marked in the case of the peninsula. The absence of coal supplies

coupled with the high cost of railway transport acted as a great handicap to the growth of industries and this had to be overcome partially by the use of hydro-electric power. The utility of forests as supplier of wood-fuel has already been referred. Many of the Indian forests are, however, confined to hilly tracts from which transport is a matter of great difficulty and expense. Moreover, it is doubtful whether the supply of wood-fuel could keep pace with the demand for it for industrial purposes. The position with regard to India's oil resources has completely changed due to the separation from India of Burma from which nine-tenth of the indigenous petroleum was obtained. As the possibility of the oil-bearing areas in Baluchistan, the Panjab, Assam, etc., must still be regarded as problematical, it would be unwise to place much reliance on this particular form of power.

WATER POWER

As is evident the situation in India with regard to the supply of coal, wood-fuel or oil for purposes of generation of power is not quite so favourable as might be desired. There are, however, fair prospects for the development of water power resources at its command. These have been limited so far on account of the seasonal character of the rainfall making costly storage works indispensable. In spite of this limitation, there are many potential possibilities of tremendous importance and within recent years considerable attention has been given to large hydro-electric power schemes. It is hoped that these schemes will not only serve the purpose of supplying power to the industries but also of extending the irrigation facilities in India.

ELECTRICITY FOR VILLAGES

We may even be tempted to dream of a time when every village within a reasonable distance from a hydro-electric power station will receive its supply of electric current to help the development of rural industries and increase the amenities of rural life. A start has been made and development on these lines has been undertaken extensively in the United Provinces. The power available at falls on perennial irrigation canals has been harnessed and converted into electrical energy. The power so generated is being utilized for commercial, domestic and agricultural purposes. But on the whole there are great obstacles in the path of realization of all these bright visions. The initial expense of most of the hydro-electric schemes in India is heavy. The rainfall being seasonal, costly storage constructions are necessary and the expenditure

thus incurred makes it difficult to supply power sufficiently cheaply. Whether science will be able to remove this difficulty, the future alone can show.

FLOODS AND FLOOD CONTROL

Rivers come into existence as a result of precipitation falling upon the earth's surface, and have as their chief function the drainage of the excess waters to the sea. The lands receive their precipitation at very irregular intervals, and as a result the river with a uniform discharge does not exist. If all precipitation could be absorbed into the earth to become a part of the ground water and then discharged more or less evenly the streams probably could be confined to their channels. But an important proportion of the precipitation never becomes a part of the ground water but flows quickly to the water courses, swelling the streams beyond their constraining banks. The placid stream fed largely by underground waters becomes in times of flood a raging torrent. With its capacity and its competency greatly increased, the river in flood becomes a powerful agent of destruction. Streams vary greatly in their capacity for destruction, but none is without its flood problem.

The fertile alluvial lands of the Nile, the Tigris-Euphrates, the Hwang Ho, and the Mississippi—the creation of their respective rivers—are repeatedly inundated, bringing death to millions and destruction to the works of man. The great rivers are, at the same time, the giver and destroyer of life and property. Smaller streams suffer from recurring floods, and the damage done is locally very great. The flood problem may be said to have its beginning when waters derived from run-off and underground sources spread beyond the restricting channel of the stream.

FLOOD DESTRUCTION

The predisposition of the people to pre-empt the rich riverine lands for both agricultural, industrial and commercial purposes subjects them to the hazards of the recurring floods. Many of our large cities such as Delhi, Agra, Cawnpore, Lucknow, Benares and Patna were founded upon rivers when the water courses were the principal highways of commerce. The use of lowlands for industrial and commercial purposes has caused excessive damage at times of flood, due both to the destruction of property and the suspension of business. Lands once used for private purposes are not easily relinquished, for the owners, especially if individual land-holders,

can hardly afford to abandon the properties to the use of the river. In such areas the recurring floods cause increased damage due to an increase in property values through the years. Urban areas subject to floods are abandoned only with great difficulty, for both industries seeking lowland values and people of the low income class seeking low rentals are likely to locate on these cheaper lands along the rivers. Protection against floods is sought before abandonment is considered. If protective embankments prove adequate, property values increase and the utilization of land is intensified. Then an unprecedented flood which breaks through the embankments causes great damage. The increased property damage in many cities is due to man's encroachment upon the river.

In agricultural areas the amount of damage depends upon the intensive economic use to which the land is subjected. The inundation of the crop lands may greatly reduce the yield or completely ruin the crop. The losses in rural areas are off-set in part by the enrichment of the lands by the deposition of silts. The fertile topsoil eroded from the slope land within the drainage basin is deposited in part along the alluvial plains of the master stream and the major tributaries if they are aggrading streams. In some areas the spreading of coarse sand and gravels along a floodplain may depreciate the value of the land for crops.

CAUSES OF FLOODS

Floods are results of many conditions working singly or in combination. Usually no single cause can be assigned the whole responsibility. The immediate cause of most floods, however, is the excessive run-off from precipitation of high intensity, though many other conditions may be necessary to cause a great flood.

FLOOD CONTROL

To escape from the danger of floods various control measures either singly or in combination have been utilized to provide the necessary protection. Probably—one of the earliest methods used to escape from floods was to evacuate the area at the first warnings of impending danger. Flight to safe areas could hardly be interpreted as flood protection but it did mean the protection of life and a limited amount of property. This method is still used when other methods of protection fail. Throughout the history of civilized man the fertile lowlands have been preferred areas of habitation; and as high waters menaced periodically the homes of the people the protecting dyke or embankment became one of the first methods

of defence against floods. In other countries the flood problems are being attacked by various methods. One of the simplest and most individual methods of flood protection is channel improvement. Embankments are very commonly associated with other local preventive measures used along the smaller as well as the major streams. Further the problem of flood protection may be partially solved by the use of preventive works in the head stream area of a drainage basin. Under certain conditions these storage reservoirs not only provide a solution to flood problems but may be used for other purposes such as water-supply, power, irrigation, etc.

THE RESPONSIBILITY FOR FLOOD CONTROL

The control of floods is a responsibility which extends beyond the limits of the inundated area. Floods have no respect for political jurisdictions, just as political boundaries show little relation to hydrographic boundaries. Since flooded areas seldom coincide precisely with political areas, the existing minor civil divisions such as tahsils and districts are unable individually to cope with the flood problem.

INDIVIDUAL RESPONSIBILITY

The flood problem begins with the formation of tiny rivulet in the farmer's field. Its control is both a personal and a social responsibility. His personal interest is not confined to the hazard of floods on his farm but to the associated loss of soil as the run-off gathers into rivulets which converge into larger and more devastating streams, producing both water and soil damage.

The individual land-owner, though he may have a humanitarian interest in the flood hazards of the drainage basin in which he lives, can do little towards the solution of the problem, especially if he lives beside a large stream. In rural areas when streams are small individual farms may, by channel improvements and the construction of embankments, give protection to their low-lying lands. The clearing of a stream channel of driftwood, trees, and other obstructions may so facilitate the flow during the time of high water that the channel is widened, thus increasing its capacity.

Imperceptibly the personal responsibility of many individuals enlarges to a regional responsibility co-extensive with each important drainage basin.

REGIONAL ASPECTS OF FLOOD CONTROL

Planning for the best use of water resources is essentially a regional responsibility, the region being coincident with the drainage basin of the streams concerned. This concept of the planning region cannot be adhered to rigidly, for the transmission of water-power in the form of electricity and the distribution of water for irrigation and municipal purposes extend far beyond the limits of the drainage basin, and require a modification of the hydrographic region to include adjacent areas which constitute the peripheral sections of an economic region.

The problem of flood control, however, is rather strictly confined to the drainage basin. So long as control measures involve only riverine works the plan would require the co-operation of river-side communities; but as control is extended to include preventive measures the whole drainage basin should be organised into a unit. The obstacles which make difficult the realization of this ideal are many, and probably will stand in the way of a strictly regional organisation based upon the hydrographic basin.

RESPONSIBILITY OF THE PROVINCES AND THE CENTRAL GOVERNMENT

Where a drainage basin lies entirely within a single province the responsibility of handling the many water problems lies on it. Flood problems which involve two or more provinces may require inter-provincial co-operation in order that a flood-control programme may be extended to all parts of the drainage basin. The co-operation should include not only an inter-provincial agreement but also a uniformity of laws to facilitate the work connected with flood control. The state's responsibility also extends to finance the operations. For such purposes excessive expenditures may be justified, but there should be a careful scrutiny of all flood-control plans to make certain that the benefits to be gained equal or exceed the cost of the protective works.

CONCLUSION

In conclusion I would emphasise that soil erosion in India has become a matter of vital concern and demands immediate attention. The improvement and fertility of Indian soils is another important problem. Planning on a wide scale to maintain soil fertility is, therefore, of supreme importance to the country in her campaign of rural reconstruction. The rapid increase in population since British occupation has greatly intensified pressure on

the land, caused the cultivation of much unsuitable ground and shortened the resting periods between cultivation that are frequently necessary for the stability of tropical soils. The human population of India is increasing at the rate of about 4 to 5 millions per annum. Much of this increase is occurring in the tract where nature in the first place provided easy conditions for human settlements, namely rainfall not too heavy for the ordinary farm crops, and natural grasslands in which cattle thrive. Therefore, much of the weight of this increasing population is falling upon the tension belt where grassland can persist only under reasonable treatment, and if once destroyed cannot reinstate itself as easily as it can under a slightly heavier or better distributed rainfall. Hence over very large tracts of country natural grasslands have already disappeared and village livestock are dependent upon bush and tree growth for their day-to-day existence. The amount of erosion caused directly through over-cultivation and over-grazing has become a national menace.

The conservation of forests and water resources of India are also vitally connected with the problem of ever-increasing population of the country and require a sound planning.

We should, therefore, recognise that problems of conservation are vital to each and every citizen of the nation. To one who is alive to the significance and magnitude of the problem of providing the posterity with the means of a richer and happier life, the conservation of the natural resources and their economic exploitation will appeal to be the only possible solution. The development and administration of conservation projects will demand the full time of a large staff of experts maintained by the State, and it is gratifying to note that the Imperial Council of Agricultural Research and Provincial Governments are directing their strenuous efforts towards the execution of such project; yet much cannot be achieved without the cordial support and co-operation of all citizens whether they are developing natural resources which they own privately or developing resources on public lands. The spirit of conservation demands that we recognize limitations to our personal rights in the utilization of gifts made by nature and render best services in the execution of local, provincial and national projects of conservation.

Agricultural Marketing in Western United Provinces

By

V. S. MATHUR, M.A., (LONDON), DIP: ED: (CANTAB), F.R.G.S.

When the crops have been harvested the next step is to dispose them off profitably and without any damage to the grain. This primarily involves a study of the marketing and storing practices of the region and then a study of the means of communication and transportation.

The common practice that has been prevalent in our region and in India as a whole is quite simple. The farmer, after keeping enough food for his family, sells his grain to the village 'bania' or wholesale purchaser, who very frequently is in the know of things and pays a very low price to the farmer who is always in an immediate hurry to dispose off his goods lest they be damaged owing to faulty methods of storing. The 'bania,' who knows all about the outside prices, earns huge profits.

Of late years marketing in Western countries has become advanced, scientific and complicated, and is not a simple exchange between the producer, the bania and the consumer, but not much of this can be applied to India. We can hardly claim our marketing to be systematic. And in the marketing process mentioned above, the producer is the loser. He has to submit to the terms dictated by the 'bania' who is very often the man to whom the farmer is very heavily indebted.

It is obvious that the more common practice if not the universal one, in pre-British India, when there were no railways and post-offices, was for the grower to exchange his produce for the goods he required. If rent was to be paid to the landlord, it usually took the form of payment in kind. The marketing was based on the isolated efforts of the peasant and the Bania. Organised business centres were non-existent. The cultivator had practically no chances of marketing successfully. The farmer is a necessitous creature and he hurries to sell his crops soon after the harvest and does not wait for better prices because his immediate need is cash to pay the rent and to pay back some of his ever increasing debt, and secondly because there being no good storage facilities available, he is afraid lest his goods get spoilt.

Perhaps he did not want to go to the distant markets which inevitably involved high expenses; and perhaps he did not know of any profitable means of grain-storage. The regular construction of roads and railways has shortened distances. The opening of the Suez Canal in 1869 has linked him with European and subsequently American markets. His bargaining power is gradually increasing.

The English eye realised the role of efficient marketing in the rural and agricultural development of the country and appointed from time to time several commissions,* to suggest improvement.

The United Provinces were the first to appoint local marketing officers to collaborate with the central marketing staff. A series of marketing surveys with special reference to the more important commodities, e.g. wheat, sugar-cane, cotton, etc., have been planned out.

Specialised markets are very few, and those that exist serve as central stations for the collection and distribution of the various crops of the neighbouring areas.

At the top is the Chamber of Commerce, Cawnpore, then come the wholesale markets generally called 'Mandis.' The bigger 'Mandis' have their own organisation, while the rest including rural markets are not controlled. The buyers and sellers are left to deal between themselves.

The appended map shows the position of the bigger commodity markets in our area. They are (*vide map*) :—

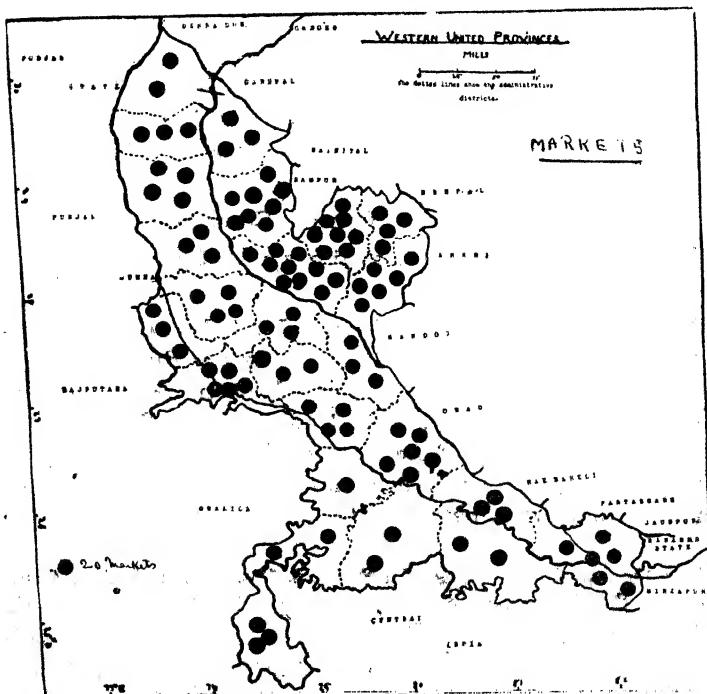
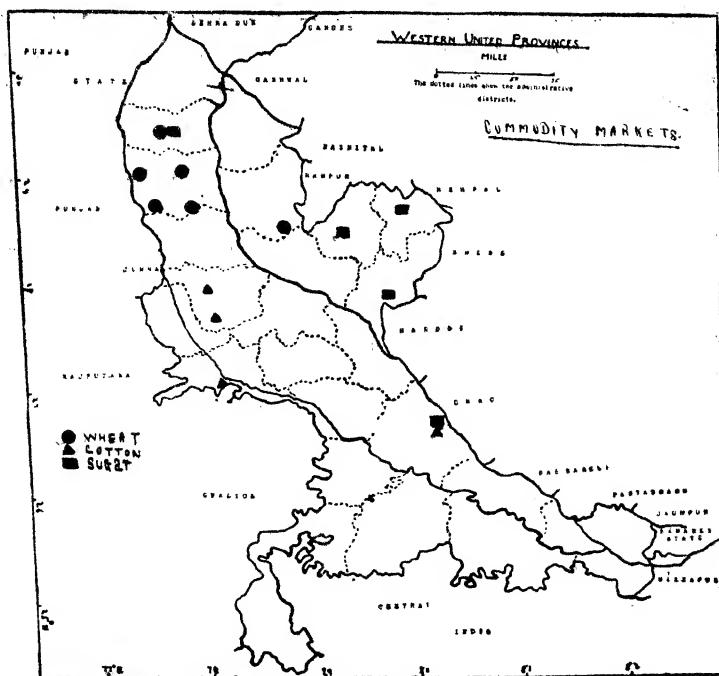
Wheat : Meerut, Muzaffarnagar, Chandausi, Hapur, Hathras, Ghaziabad.

Cotton : Agra, Aligarh, Hathras, Cawnpore.

Sugar-cane : Bareilly, Shahjiharpur, Cawnpore, Muzaffarnagar.

Hapur is the biggest 'Mandi' in U.P., and together with Amritsar in the Punjab has snatched from Bombay the place of honour in the matter of supremacy in the wheat trade. It has its own Chamber of Commerce, its daily trade news bulletin and its forward transaction. The 'Mandi' also makes efforts towards preventing adulteration of produce, simplifying marketing charge and organising trade on a better footing.

* The Famine Commissions of 1880, 1898, 1901 ; the Irrigation Commission of 1903 and the Committee of co-operation of 1915 ; also the Royal Commission on Agriculture in India, 1926.



In some villages are found a few local markets where the producers take their produce for disposal. The map showing the distribution of village markets tallies fully with the map showing the distribution of cultivated area. Distribution of grain markets is essentially controlled by the distribution of agriculture and ultimately by geographical environment.

The village markets involve bazar-like dealings rather than organised trade. Mostly the markets are held once or twice a week in some open space, and that day is a day of holiday in the village when all go shopping. They are without a system and involve arduous travels over rough and unmetalled roads which however the farmer prefers to going to bigger markets by rail or motor. And the villager prefers selling his produce in these village markets because bringing produce in the big 'Mandis' involves a good amount of money for transport and carriage charges, and then the wholesale dealers quote their own terms which are seldom reasonable, with the result that either the villager has to take back his goods or sell them at a loss.

There is no marked tendency towards co-operative marketing of agricultural produce. Solitary institutions work here and there, but they are hardly able to cope with the demand. More co-operative societies could function on these lines to the great advantage of the cultivator. They could give advance money to the producers until they get a fair value for their produce. Besides, they could educate the cultivator in improved methods of production and preparation of his produce, facilitate the grading of produce and put the backward village farmer in touch with the bigger markets.

The holding of surplus supplies from periods of plenty for periods of scarcity is one of the most essential items in profitable marketing. The economic advantage of storage is that it aids in adjusting variable supplies to the relatively constant needs of the buyer.

Unless storage is safe and free from damage by insects, rodents etc., it cannot prove profitable. Cultivators store grain in their houses in earthen pots or in a corner of a small living room. Both the practices are practicable only for small quantities. For bigger amounts 'Khattis' or cells in the ground, or barns are preferred but in both places there is danger of damage. The bigger merchants generally use the latter places. Even in normal years there is a considerable amount of deterioration in the quality of the grain, besides the damage on account of rats, sub-soil damp and the consequent chemical reactions. At Muzaffarnagar the author was

shown round by an official of the Grain Chamber some of the newly built 'Khattis' or storage pits made of reinforced concrete. The official said that these scientific pits were water-proof, insect-proof and hygienic. There is a tendency in that market to abandon the old 'Khattis.' These new storage chambers of reinforced concrete in Muzaffarnagar are the first of their kind in Northern India and it is hoped that other big markets like Hapur will soon follow suit.

Both marketing and storage development should be a concern of the agriculturalist and the wholesale dealer; and organised marketing, direct dealing, thereby eliminating the village 'bania' or the middleman, should be encouraged as it brings village prices into greater accord with local 'Mandi' prices, to the benefit of both the producer and the buyer. That private enterprise is not forthcoming is to be regretted. Any scheme planned and financed by the Government can hardly succeed without the co-operation of the people.

This line of improvement is directly connected with the agricultural development of the region. It will not be very wrong to say that the development in marketing (to enable the producer of the crop to have some profit out of his produce) has a direct bearing on the subject of agricultural development and should go parallel with that of the latter. Unless he gets profit and is sure that if he grows more, he will earn more money, the cultivator will be very reluctant in trying to increase his acreage under crop, or make better use of the irrigational facilities or the other improvements introduced hitherto.

An Appeal to the Universities of India for Considering the Position of Geography as a Science

By

PROFESSOR M. B. PITHAWALLA, D.Sc. (GEOGRAPHY), Karachi.

It is high time now to make an earnest appeal, through the medium of this popular Journal, to the authorities of all the Universities of India, for considering seriously the position of *Geography as a Science* and for developing its studies in the Faculties of Arts, Science, Commerce, Agriculture and Technology. Though Geography is a science of recent growth, it is not to be regarded in any way to be less important than the other branches of Science ; on the contrary its claims are superior to those of some branches at least, and in this respect it must be remembered that its studies are greatly neglected by our Universities, unlike those of the West, which prescribe it not only as an independent subject of study and research but also as a subject allied to history, economics, ecology, anthropology, military science, etc. Hitherto Geography has been considered as a dry subject of no great importance, a mere matter of facts and figures to be crammed up at the Matriculation or Intermediate Arts examination only. But this state of affairs must now change and it must be regarded as a science of vital importance to India.

Comparative Statements of Indian and Foreign Universities

In support of my views, I give below a Statement (marked A) showing the position of Geography in all the 19 Indian Universities and another (marked B) showing its position in some foreign Universities. From these it will be clearly seen that while some advanced Universities have introduced Geography not only as a subject for examinations in the Arts as well as Science Faculties but also as a subject of research for higher degrees, others have done practically nothing in the matter, e.g. Bombay. By them just a spoonful of it has been prescribed for the Matriculation examination as a minor section of a paper and as an optional subject merely for the First Year or Intermediate Arts but without any practical test or examination, so that full scope has been given to the candidates for mugging up the subject, for examination

purposes. Such an attitude of a great University towards a subject of vital importance to students is indeed deplorable. I have, since 1932, made frequent appeals to the authorities in this connection in my own individual capacity but have invariably failed and papers have been merely filed or recorded.

Importance of Geography as a Science in these times

Geographical studies, in my opinion, must be considered to be particularly important especially in these days of a world conflagration. Mr. N. Subrahmanyam, the Editor of this Journal has cleverly called it a *Geography War*. The League of Nations did their level best to popularise it. This is indeed a War in which geographical circumstances and geographical factors are performing a most prominent function. It is the geography of Europe and other affected parts of the world that has been the director of all land, sea and air operations. Several of the British and other professors of Geography are now working with the R.A.F., Fleet and Army at many places. Great nations such as U.S.A. are making defence preparations based upon the geography of their lands. But, unfortunately for our country, the students are kept painfully ignorant of these vital factors. For India particularly, Geography, must be of far more importance to them than even history, because the present position of the world affairs shows an ever-increasing interdependence of one nation upon another, and the more they know about each other's outlook, the better would it be for all, as the more likely we will all be to come to an amicable understanding and friendly relationships. I make bold even to say that the political and social problems in India itself can be easily solved, if our young men and women are made really to understand the *natural factors* working *behind* all human struggles and endeavours. It is, therefore, that many foreign Universities, which are up-to-date, encourage Geography and geographical research at their centres.

Utilitarian Value

Geography has an *educative* as well as *utilitarian* value. There is an increasing demand for specialist Geography teachers in all our Schools, Primary and Secondary. The Madras University diploma has been so highly valued in South India and the Madras Geographical Association has shown the way to workers in the other parts of India, by means of the Vacation and Refresher Courses, how we can make our school teaching ever fresh and ever living. More than anything else, our students should know all

about the natural resources of our country and of other countries coming in contact with it, so that they may, when their time comes, give their share in the proper regeneration and development of their mother land which has such vast potentialities. Even the weathers and climates of India are so poorly understood by many; there is a great loss of knowledge and consequently the rising generation is becoming more and more powerless and restless.

Geography has an Interpretative Function

Geography has also an *interpretative* function. It elucidates and re-interprets the *complex* relations between the physical environment on the one hand and the distribution, mode of life and economic and social activities of man on the other hand, both in the present and the historic past. Such an elucidation of new relationships is accepted by Western geographers as a contribution to Science; but in this respect also our Indian Universities are very backward.

An Aid to other Sciences

The aid, which geographical research can render to allied subjects, history, economics, sociology, commerce, agriculture, etc., is valuable. No study of these subjects could be *complete* or *thorough without the background of Geography* given to it. This aspect of our Science has been well emphasised by foreign Universities, such as London, Oxford and Cambridge, as will be seen from the Statement B.

India's Contribution to Indian Geography

Not depending upon outsiders, our University students should soon learn to give their share in producing a reliable, and scientific Geography of India, which yet remains to be explored. This requires specialistic knowledge which we must foster at our University centres. (*Vide* My note on M.A. and M.Sc. courses). Instead of making our students dreamers and idle dabblers in politics, we must help them to turn out good and useful work for the advancement of our country. In this direction, a good beginning has been made by local Indian geographers at Madras, Aligarh and Calcutta who deserve our grateful thanks.

Practical Side of Geography

It is a grave mistake to suppose that there is no practical side of Geography. All our teaching is ruined on this account and the

science of Geography is murdered. While there is always a practical University examination in connection with other Science subjects viz., Physics, Chemistry, Biology and Geology, there is no practical examination held, even at the Intermediate stage, by some of our Universities. The result is that students are tempted to *cram* the facts of geography without knowing their bearing on daily and practical life. Students have much to learn and do practical work both in the laboratory and in the field. Among the practical aspects of Geography are field surveying, aerial surveying river, lake and ocean explorations, mountain expeditions, map making and map reading, enlarging and reducing maps, cartographical representation of data and statistics and identification of specimens of various kinds in different physiographic regions of India and other lands. All this requires *laborious* laboratory and field work and exercises which no other branch of Science needs. It is, therefore, absolutely necessary that with every theoretical Paper in Geography, there must be a *practical and oral test* so that the whole study may become *realistic*.

Board of Studies in Geography

All this cannot be achieved unless a *special and competent* Board of Studies in Geography is instituted by the Universities. Hitherto the work has been relegated to other Boards of Studies *indifferent* to the interests of Geography or to persons *incompetent* to deal with the subject adequately. Unlike other subjects of study, Geography has many branches, all of which should be properly represented on the special Board; otherwise the subject would suffer considerably. In the University of London, for example, there are as many as 18 Members, representing physical, historical, economic, biological, agricultural, ecological, anthropological, archaeological, commercial, and human geography, etc. With such a Board there must also be made provision for a representative of it on the Academic Council and the Executive Body of every University, so that plans made by experts in the line may not be thrown aside by *laymen* and *interested parties*, as has been the case hitherto.

To sum up

I earnestly desire that Geography and geographical teaching in our Indian Universities should be placed on proper and sound lines without unnecessary delay, so that the rising generation in our country may not suffer and their education may not be defective.

For this purpose only and with no other motive, I appeal to the authorities to achieve the following as soon as possible:

(1) Separation of Geography from History at the Matriculation Examination, as a compulsory subject.

(2) Introduction of Geography at the Intermediate Arts, Intermediate Science, Intermediate Commerce, B.A., B.Sc., B.Com. and B.Sc. (Economics) as an optional subject with Papers as well as Practical Examinations.

(3) Encouragement of geographical research side by side with allied subjects of Ancient and Modern History, Economics, Sociology, Anthropology, Archaeology, etc., at the University Schools and Departments of Economics, Sociology etc., and at other Institutions affiliated to the Universities for post-graduate research.

(4) Introduction of Geography in the Department of Military Science as a compulsory subject.

(5) Institution of a Diploma in Geography for School Teachers (for a 2-years' course after Matriculation), if it is not yet done.

(6) Establishment of a Chair of Geography in the Universities for all Honours and postgraduate teaching, or in case it is already established, its expansion into a University Department of Geography in relation to Economics, Sociology and History on the Art side and to Geology and Biology on the Science side, with a well-equipped laboratory and facilities for field work.

(7) Institution of a special Board of Studies in Geography, or if one is already in existence, its expansion in such a manner as to serve the interests of *all* the branches of Geography, and its proper representation on the Academic Council and the Syndicate.

STATEMENT A

*Position of Geography in Indian Universities (those marked * have developed the Science well)*

No.	Name of University.	Inter Arts.	Inter Science.	B. A.	B. Sc.	Other Exams.	M. A., M. Sc.	Ph. D.	Remarks.
1	AGRA	.....	.....	B.A. (2 Papers)	.....	Inter Com. (1 Paper)	.....	.....	.....
*2	ALIGARH	Inter Arts (2 Papers)	Inter Sci. (2 Papers)	B.A. Pass (2 Prs., 1 Fr.) B.A. Hons. (5 Prs., 1 Fr.)	B. Sc. Pass (2 Prs., 1 Fr.) B.Sc. Hons. (5 Prs., 1 Fr.)	B. Com. (3 Papers) B.T. (1 Paper)	M.A., M.Sc. (8 Prs., 1 Fr.)	Ph. D. Thesis	1 Uni. Reader 4 Lecturers 4 Demonstrators.
3	ALLAHABAD	.....	.....	B.A. Pass (2 Papers)	.....	B. Com. (1 Paper)	.....	.....	Allied with Commerce. 1 Reader 3 Lecturers.
4	ANDHRA	Inter Arts (2 Papers)	Inter Sci. (2 Papers)	.....	.....	B. Com. (1 Paper)	.....	.....	.....
5	ANAMALAI	Inter Arts (2 Papers)	Inter Sci. (2 Papers)	.....	.....	.....	.....	.....	.....
6	BENARES	.....	.....	.....	.....	B.T. (1 Paper) Inter Com. (1 Paper)	.....	.....	.....
7	BOMBAY	.....	.....	.....	.....	F.Y.A. (2 Papers) B.T. (1 Paper)	.....	.....	D.Sc. can be taken by published Research.
*8	CALCUTTA	Inter Arts (2 Prs., 1 Fr.)	Inter Sci. (2 Prs., 1 Fr.)	B.A. Pass (2 Prs., 1 Fr.) B.A. Hons. (4 Prs., 2 Fr.)	B.Sc. Pass (3 Prs., 1 Fr.) B.Sc. Hons. (4 Prs., 2 Fr.)	B.T. (1 Paper) Military Cer. (1 Paper)	Proposed M.A., M.Sc. (5 Papers) (3 Practicals)	.....	1 University Lecturer- in-charge.
9	DACCA	.....	.....	.....	.....	B.Com. (1 Paper)	.....	.....	.....

N.B.—1. The above information has been gathered by me from the latest edition (1940) of *Handbook of Indian Universities* (Inter-University Board, India) and by personal inquiries.

2. In some of the above Universities, Geography is prescribed only on paper, but the Colleges affiliated to them have not seriously started its teaching. Though there is a dearth of qualified University Teachers of Geography, an attempt is not yet made by the authorities to induce men of Science to take up geographical research.

STATEMENT B

Position of Geography in Foreign Universities

N.B.—In well-known foreign Universities of Great Britain, Europe and America, Geography and geographical research have a prominent position in various Faculties, Arts, Science, Commerce, Economics, Agriculture etc.

University of London.

1. Geography is an optional subject for all Arts and Science examinations from the Intermediate to the final degree stage.
2. There is a special Academic Diploma in Geography instituted for Teachers.
3. Geography is a subject of research for postgraduate degrees of M.A., Ph.D., D.Litt., and D.Sc.
4. For B.Sc. (Economics), Geography is a *compulsory* subject at the Intermediate stage and again an optional subject at the degree stage e.g. Geographical discussions and geographical background of International Relations.
5. For M.Sc. (Economics), there is prescribed a detailed economic geography of an area or some aspect of geography chosen from agricultural, industrial or historical geography of a major region, population problems etc.
6. For B.A. Final Honours in Anthropology, there is a *compulsory* course of geological and geographical conditions of racial and cultural developments and the distribution of races.
7. At the London School of Economics especially, provision has been made for maintaining one Professorship, two Readerships and three Lectureships in Geography, besides similar posts in other University and affiliated Colleges for Arts and Science.

University of Cambridge.

1. Geography is prescribed for Intermediate Arts and Science, B.A. B.Sc., Intermediate Commerce and B.Sc. (Economics).
2. In the Final Honours and Post-graduate courses, there are prescribed Historical Geography, Agricultural Geography, Current Literature on Geography, Geographical Distribution of British Industries, etc.
3. Research Seminars in History teach *Historical Geography* especially.
4. There is a Diploma in Geography for Secondary Teachers.

5. The University maintains a Professorship and a staff to carry on Laboratory and Field Work for Geography.

University of Oxford.

1. This University maintains a special Honours School of Geography, designed to provide a course of instruction in Geography which may afford a preparation for further study and for geographical exploration.
2. In the Honours School of Modern History, *all* candidates are expected to have some knowledge of political and descriptive Geography.
3. There is a Diploma in Geography instituted and candidates for it are required to present a *thesis* of geographical description of a selected district as a part of their examination.
4. Special Certificates are issued for Proficiency in Surveying and General and Regional Geography.
5. At the B.A. and B.Sc. examinations, Geography is an optional subject.
6. Research and Superior degrees e.g. D. Phil. can be taken in Geography.
7. A Professorship and Staff are maintained at the Honours School.

N. B. Information has been gathered from the University Calendars or Handbooks.

Geographical Distribution of Religious Places in Tamil Nad*

By

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The Tamilian scholar divided the country into 5 natural divisions according to its physical features. In his poetical imagination he carried such ideas into his daily life. It entered into the manners and customs of the people. In course of time such divisions and the attributes to them became conventional. If a poet dealt with a particular region in his poem he always associated his thoughts to the particular sect of people who inhabited it, to the particular products growing in the tract, to the particular kind of song, amusement, festivity, food, dress, musical instruments and other ideas connected with the region. The grammarians developed these ideas into a hard and fast convention which has been left to their successors as an inheritance. Even in modern Tamil poetry, we find the poets adopting such conventions and forms. The ancient scholar named such regions by the name of a particular flower or plant which grew extensively in that region. Hence we find that the sea coast and the sandy tract along side of it, was known by the name of the water plant, 'Neithal' and the river bank with the fertile wet lands and civilised cities by the name of the tree known as 'Marutham'. The grassy plains where dry crops are grown and where shepherd used to graze his cattle and sheep by the name of the flowering creeper 'Mullai'. The hills and the forest country by the name of the forest plant 'Kurinji' and lastly the deserts and the wastes by the name of the tree 'Palai'. These poetic divisions are based on nature and but for the water-tight conventions developed by poetical imaginations based on such conceptions such divisions would have been more natural than any other kind of division.

On the other hand the politically minded Tamilian divided the country into divisions based upon the extent of land reigned by certain tribal heads. In the early days, Tamilians were ruled by three regal tribes known as Chera, Chola and Pandya. The heads of these tribes were known by the particular title of "Ko". The other

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chieftains who were subordinate or rather feudatory to them, were never dubbed with the honorific title 'KO'. The capitals of these three reigning monarchs were 'Vanji', 'Woriyur' and 'Madura'. In later days the capitals of the latter two were shifted to such places as Puhar and Korkai. These political divisions often changed in extent and in boundary according to the growth and decline of various dynasties. About the 4th century A.D. a new power appeared in the Tamil country under the name of Pallava with its capital at Kanchi. Though the boundaries of these kingdoms were often described with a sort of definiteness as Chera, Chola, Pandya and Thondai Nadus, yet we find in the political history of the land that their extent varied often. Hence we find that though the nucleus of the division was somewhat fixed and definite, the extent of the kingdom was never constant. Sometimes we even find one country being swallowed up by another. During the time of the imperial Cholas of the Vijayalaya Dynasty the Pandya and the Pallava territories came under their suzerainty. During the 13th century Maravarman Sundra Pandya swallowed Chola and Pallava territories. In this way we find that the political units were never the same throughout history.

On the other hand, we find that there was a constancy in the division of land based upon religious ideas. During the 3 centuries following the Saiva and Vaishnavite revival in the early part of the 6th century, Saints appeared in the country and revived the two great religions and suppressed the then prevalent Buddhism and Jainism. The four great Saivite saints and the twelve Alwars travelled throughout the length and breadth of the land for the purpose of instilling religious spirit among the people, visited a large number of temples and have sung songs about them. While so doing they had mentioned the names of the divisions in the land. The other Saints and poets who followed them developed the idea still further and have fixed the extent of the divisions while mentioning the temple which they visited. In this way the division of land into various sub-divisions on religious basis became settled and were in vogue among the people. Such divisions which were fixed definitely by the religious Saints are as follows:—

1. A set of 3 maps of South India and Ceylon with the 7 Nadus and Siva and Vishnu sacred places and routes recorded and published by the Madras Survey Department, can be had from N. M. Subraya Mudaliar of Palur, Chingleput District.

2. A Tamil hand-map showing the abovesaid details with a guide can be had for annas four at Saiva Siddhanta Mahasamajam, Kallukaran Street, Mylapore.

- Chera Nadu.—Malabar, Cochin and Travancore.
- Chola Nadu.—Trichinopoly and Tanjore.
- Pandya.—Madura, Ramnad and Tinnevelly.
- Kongu Nadu.—Coimbatore, Salem, a part of Trichy and a part of Madura.
- Thondai Nadu.—Chingleput, North Arcot and a portion of Chittoor.
- Tulava Nadu.—Kanara.
- Vada Nadu.—The country north of Tamil Land.

Besides these divisions, in later days, South Arcot which originally formed part of Thondai Nadu became known as 'Nadu Nadu'. There are a number of stanzas found in literature which give the extent of these Nadus. Moreover, we find that each temple is associated with a particular Nadu to which it belonged. Not only by tradition but also in *sthala puranams* which give an account of the temple, a description of the Nadu in which it lay has been given. As a result of this classification we find that though the political divisions of the country increased and decreased according to the growth and decline of a dynasty the religious divisions of the land never changed, either in extent or in name. During Chola period, we find that the names of territories were being constantly changed according to the whims and fancies of the conquerors. The victorious Monarch desired to perpetuate his name as well as the names of his relatives in christening the newly conquered territory with their names. But the people do not seem to have approved the new-fangled ideas of the Monarch and never brought them into practice. But for the inscriptions found in temples, we have no opportunity of knowing the names given by these Monarchs. The people at large have retained the names of divisions given by the religious saints, preserving them till the modern times traditionally. Hence we find that for the last 14 centuries divisions according to religious ideas only have been prevalent among the Tamilians.

Such being the case, we can classify the divisions of the country according to the number of religious institutions found in them, and study how far religious spirit had existed in the land. The Saints who lived in the country from the 7th to the 10th centuries have left a record of the number of institutions visited by them. From this list we can say that these were the most prominent institutions which existed in those days. Subsequently a good number of institutions have come into existence for various reasons which we shall discuss later on. Herein we give a list of the number of temples which existed during the time of the Saints :—

<i>Division.</i>	<i>Saiva.</i>	<i>Vaishnava.</i>
Chera	1	13
Chola	192	40
Pandya	14	18
Kongu	7	—
Nadu	22	2
Thondai	32	22
Thulu	1	—
Vada	5	13
 Total	 274	 108
	—	—

From the above list we can easily grasp the idea how religious institutions came into existence more in certain tracts and less in others.

At this juncture, we should remember that temples came to prominence by their contact with saints and their being recognised and consecrated in their songs. The mere visit by a saint exalted the sacredness of the place in the eyes of the devotees. The temples which had the honour of being sung by saints were known as 'Padal Petra Sthalam' in Saivite lore and 'Mangala Sasanam Petra Sthalam' in Vaishnavite Literature. The other minor temples which were merely mentioned casually in the songs were dubbed by the name 'Vaippu Sthalam' in Saivite literature. The importance of a temple which was a Padal Petra Sthalam can be easily understood from the fact that even in modern days a rich and pious money-lender of Nagarathar Community would never consider to renovate any other temple than that which was sanctified in the songs of a saint. Such being the case, we can easily understand how places became sacred by the tread of the feet of the saints.

That a certain saint was born in a certain tract, that he preached in a certain tract and that he left the mortal coil in a certain tract, will always be an indication to the increased number of institutions in those tracts. *For instance Nadu Nadu (South Arcot) was famous as the birth-place of the two saints, Appar and Sundarar; Chola Nadu of Sambandar; Pandya Nadu of Manicka Vas-

*Appar	..	Tiruvamur
Sundarar	..	Tirunavalur
Sambandar	..	Shiyali
Manikkavasagar	..	Vādavur

gar. As a result of such an importance, we find groups of temples round about the birth-places of those saints. Similarly in Vaishnavism we find, Ten Pandya Nadu being the birth-place of Alwars, Nammalwar, Perialwar, and Andal. Madurakavi also belongs to Pandya Nadu. Chera Nadu gave birth to Kulasekhara, Chola Nadu to Tirumangai Alwar, Thondai Nadu to the first three Alwars and Tirumazhisai. About the 12th century A.D. the Vaishnava Acharyas Ramanuja, Tirukachi Nambi, Tirumalai Nambi and a number of others appeared in Thondai Nadu. As a result of such births we find that a good number of Vaishnavite shrines springing up into importance round about the birth-places of these saints. Hence we find that the existence of religious reformers gave not a little incentive to the growth of religious institutions in various places. In later days we find a number of saints and religious poets appearing in the land and sanctifying other places. Moreover the Imperial Cholas, Pandyas, Vijayanagar Emperors and their vassals Tanjore and Madura Nayaks nurtured temple renovation work to a great extent. In this way temples increased in the land. I am giving in the end the number of religious institutions in each district as are found at the present day with the revenue which they pay to the Hindu Religious Endowment Board.

In this connection it would be interesting to bestow our attention to the origin of temples and their gradual growth. We will first consider the traditional origin of temples in our country and later on about the historical aspect of it. In Tamil Land there are a good number of traditional accounts as well as folklore tales about the origin of temples. We need not reject them as merely fanciful ideas. In many of them there may be bits of truth from which we can deduce a good deal of knowledge. When I made a study of the folklore tales in Kongu country, I found that similar traditional tales occurred with regard to various temples in the length and breadth of the land. Regarding some of those tales we find actual record of them in the temple Sthalapurans as well as in the relief figures found on the dwajasthambams on the temple walls. One such story is found in the temple of Perur in Kongu Nadu. A cowherd was grazing his cows in a forest. One cow was

Nammalwar	..	Alwartirunagari
Peria Alwar and Andal	..	Srivilliputtur
Tirumangai Alwar	..	Tiruvali
Ramanuja	..	Sriperumbudur
Tirukachi Nambi	..	Poonamalle
Tirumalai Nambi	..	Tirupati

not yielding milk. While reprimanded by his master he went along with the cow to find out the truth. The cow was found milking of its own accord on a round piece of stone under a bush. The infuriated cowherd boy gave a lash on the cow, which jumped and hit the stone. Blood came out of it. The boy fell unconscious. The master coming to know about the incident cleared the bush and built a temple over the lingam thus manifested. This is the origin of the temple at Perur. Similar stories are found in a number of other temples in Tamil Country. Similarly a villager was digging to get a root of *Valli Creeper* and his axe struck a round stone and blood came out of it. It was found that it was a lingam and a temple was constructed on it. This is the origin of Annur in Avanashi Taluk. While a tribe emigrates from one country to another due to repression or famine they carry all their belongings to their new homestead. Tradition always says that along with their moveables one stone is always found in a basket carried by a woman and comes back even if thrown out. Later on the tribe learns that it is their family deity and at their new home a temple is constructed. These are a few oft-quoted traditional accounts current about the temples.

While such are the natural traditional accounts, we find in various other places, constructed temples where the images of deities made by a sculptor were installed. Devotees established new temples out of mere piety or when their desires were fulfilled by any divine act. Recovery from small-pox, cholera, plague and other dire diseases often prompted devotionally minded folk to establish new temples. Victory, sudden affluence, daring act are some of the common causes for new construction of temples. Heroic act by a warrior or a brave villager in fighting with an enemy or with a wild beast in order to protect the public often formed an incentive to erect a temple on the remains of the person. Similarly temples arise in the spot where a widow burnt herself with the corpse of her husband in order to keep up her chastity. Such are some of the instances in which temples were formed in the country.

Coming to the historical side of the origin of temples, we are told that temple construction in the Tamil land came into existence only after the 4th and 5th centuries of the Christian era. The ancient Tamilians worshipped Nature and natural objects; and later on they used to instil a few rough stones as objects of worship under the shade of trees. Buddhists and Jains came to the south and brought their ideas of image worship. Rough stones began to develop themselves into fine figures. Tree shades gave place to

mud construction with thatched and tiled roofs. The Chalukyas dug cave temples for their Gods in the Deccan in imitation of Jain Monasteries. The Pallavas followed them in the 5th and 6th centuries in the South. In course of time cave temples gave place to cut-stone granite temples. The Imperial Cholas developed them into artistic ones with huge gopurams. Pandiyas, Hoysalas and the petty chiefs who followed them, developed single-room temples into temples with good many halls or mandapams. Vijayanagar kings lavished good deal of their wealth on gopurams, mandapams and compound walls. The result of such a development was that the shade of a banyan tree developed in course of time into a religious fortress with 7 huge ramparts round it. This is in brief the history of temple development, in the Tamil country.

The frequency of temples in Tamil country owes much to the conception of division of land by them. As already told, the Tamilian divided his country into 5 natural divisions. Among them the tract which favoured temple construction was Marutham i.e. river side and the fertile country near it. Due to the fertility of rivers and channels and lakes formed out of such channels, population increased and along with the density of population temples increased. Villages and towns grew mostly near the rivers and lakes and hence the places of devotion also improved. We find the largest number of temples along the river valleys. The Cauvery Valley had 192 Saivite and 40 Vaishnavite consecrated temples. The Vaigai valley in Pandya Nadu and the Tambaraparni valley have 14 and 18 Saiva and Vaishnavite temples. The 7 Kongu temples are on the banks of the Noyyal, Bhavani, Cauvery and Amaravathi rivers. Most of the temples in Nadu Nadu and Thondai Nadu are near rivers or big lakes. Madurantakam, Koovam and Elambayamkottur owe their existence to big tanks.

Next comes the sea coast and the sandy tracts. Often we find back-waters and lagoons intercepting the sandy tracts. Along these places a good number of temples have sprung up. The 13 Vaishnava temples and 1 Saiva temple of the West coast owe their existence to water communications. Similarly have arisen the temples of Tiruvida Venthai, Porur and Mamallapuram on the eastern coast. Tiruvothiyur, Tiruvanmiyur, Mylapore, Tiruvallicani, Tiruppappuliyur, Nagapatnam, Karaikal and Vedaranyam are on the sandy eastern coast.

Next comes the hilly tract. Throughout the Tamil country stray hills are found everywhere. None of them are allowed to escape. Every one of them is associated with a temple, especially that of the

Tamil God Muruga. There are a few exceptions where Perumal and Siva are installed. The poet Arunagirinathar has sanctified all these temples with his popular songs of Tirupugal. Besides these stray hills, we find long and high ranges of hills wherein also temples are constructed. The hills of Tirupathi, Kollimalai, Javvathumalai, Servaraya hills and Western Ghats contain famous shrines.

Among the other two tracts the up-lands or Mullai has very little fertility and temples are also few here. The 5th region Palai or desert is practically nil in the Tamil country.

Hence we find that the nature of the soil as well as that of the physical features influence largely the number of temples in the Tamil country.

We have already indicated that religious spirit, patronage of royalty, devotion of people, and nature of the land form some of the causes for the establishment of temples in the land. Besides these causes, economic conditions and resources of the people also form a good incentive for the establishment of temples. Trade and industry make people wealthy. Communications help the trade and the consequent prosperity of the people. While in early days rivers formed easy means of communication, in later days canals were constructed which helped transport to a considerable extent. The temples of Malabar owe their existence to such easy communications. Tiruvanchikazham, Tirupunathurai, Alwaye, Vaikom, Etrumanur, Alapizhai, Ambalapizhai, Varkalai and Trivandrum owe their existence to canal back-waters. Similarly there are Kovilam, Tiruvidaventhai, Tiruporur and Sadras on the Eastern coast.

Roads form an important means of communication for transport and pilgrimage. They form easy passages from one town to another. We always find that each big cathedral city is a nodal centre for a number of roads from the neighbouring country. Trade and commerce owed much of their existence to such roads. The big towns of Chidambaram, Kumbakonam, Tanjore, Trichinopoly and Madura were centres for such road connections and their temples grew rich, powerful and attractive. Recently railway junctions made the sacred places more and more popular. From time immemorial Rameswaram was the centre of pilgrimage for the entire population of India. Long before railway communication was introduced, there was a trunk road leading from northern districts along Tanjore and Ramnad to the island of Rameswaram. This road was known as Chatram Road for the reason that a number of Chatrams or centres of pilgrims halts were constructed by the then

rulers of the country. This is an interesting item which helped the pilgrims with all the conveniences which they needed. It is natural that along such tracts small temples began to rise.

As a result of the above discussion we can easily understand how temples began to grow in the country and in what way they are found distributed throughout the length and breadth of the Tamil land.

APPENDIX : (A)

Temples district-war :

Kingdom.	District	Major temples	Minor temples	Maths.
Pandya	..	597	1418	30
	Tinnevelly	211	275	4
	Madura	422	424	6
Chola	Ramnad	623	590	7
	Trichinopoly	977	2147	19
Nadu	Tanjore	477	349	13
	S. Arcot	289	170	6
Thondai	Chinglepet	324	660	12
	N. Arcot	251	238	5
Kongu	Salem	619	325	3
	Coimbatore	26	4	-
	Nilgiris	1030	180	9
*Chera or malai	Malabar			

* Before 10th century—Tamil ; later on—Malayalam.

APPENDIX : (B)

Revenue from temples at 1½ and 3% of income.

District.	(Year 1938-39) in rupees.
Tinnevelly	15663
Madura	10203
Ramnad	20669
Trichinopoly	12235
Tanjore	36445
S. Arcot	7055
Chinglepet	6985
N. Arcot	3862
Salem	3480
Coimbatore	7987
Nilgiris	483
Malabar	
Total	40368

Northern Hunters*

By

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Between the northern shores of the continents of the eastern and western hemispheres lies one of the few remaining unexplored areas of the world—the Arctic Ocean. Compared with the other oceans it is remarkable neither for its size nor its depth, but its covering of ice has so effectively hindered exploratory effort that only once has a surface ship crossed it namely Nansen in the 'Fram'. Numerous voyages have, however, been made round its edges, along the Siberian coast and among the islands of the Arctic Archipelago, but only at high cost in men and ships, and the result has been an unsavoury reputation for the Polar Ocean.

In spite of temperatures so low that in places the sea never thaws and the fact that night and day are measured by weeks and months and not hours, animal life abounds round the shores of the Arctic Ocean; and the prospect of an abundant food supply has led man too, to adapt himself to these unusual conditions. It is the object of this lecture to give a brief description of some of these northern hunters, the Eskimos of Greenland and the Canadian Arctic Islands.

It is to the old Norse sagas that we are indebted for our first records of the Eskimo. In 982 A.D., over thirty years before Canute became king of Britain, Erik the Red set out on a westerly voyage from Iceland that resulted in the discovery of Greenland and its Eskimo inhabitants. Later, other Norsemen from both Iceland and Norway followed in his footsteps and established settlements in the comparatively fertile south-west. It was while on a voyage to these settlements that Leif Ericsson was driven off his course and in 1000 A.D. discovered North America—the vinland of the Norsemen.

The Greenland colonies flourished for many years; they managed to keep cattle and sheep, run small farms and trade with their neighbours and their homeland—exchanging skins, oil and furs for much needed iron, wood and cattle. Later, however, they

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began to be less prosperous, when with the decline of the Norsemen, ships became few and far between and finally ceased altogether, the colonists being forgotten. Of the later history of the colonies there is no written record, but from archaeology we know that they became steadily more impoverished and disease more rampant, until in the end they died out altogether. A number of theories have been propounded to explain the disappearance of these settlements, since in spite of the cessation of communications with Europe, they should have been able to survive. Suggestions include a change in climate and intermarriage or disastrous wars with the Eskimos. The answer may be a combination of all three.

Greenland was re-discovered in 1500 A.D. by the Portuguese, Gaspar Corte-Real, and he was followed during the 16th century by Willoughby, Chancellor, Frobisher, Davis and others, looking for a north-west passage to the wealth of the East. Other expeditions went out during subsequent years, even after the idea of a commercially practicable north-west passage had been given up, culminating in the numerous Franklin search expeditions and Stefansson's and more particularly Rasmussen's work of recent years. All these have contributed something to our knowledge of the Eskimo, until now he is one of the better known races of the world.

To-day the Eskimos are found from the east coast of Greenland to Alaska, while a few have even crossed the Bering Strait and established themselves in Siberia. Over this enormous area there is so little variation in language that a Greenlander can make himself understood from one end of Eskimo territory to the other, as was proved by Rasmussen during his 1924-29 expedition, when he travelled from Cape York in North Greenland to eastern Siberia (where he was imprisoned by the Russians), visiting practically every settlement on the way.

Half the world population of about 30,000 Eskimos live in Greenland and, with the exception of a small settlement on the east coast at Angmassalik, all these are distributed along the west coast between Cape Farewell in the South and Smith Sound in the North. The remainder are scattered over the North American coast between Labrador, Hudson Bay and Alaska and on various islands, principally Baffin, Southampton, Somerset and Victoria. Other islands, such as North Devon and Ellesmere, show frequent signs of having once supported thriving populations, but for reasons unknown they have long been deserted.

The origin of the Eskimo is the excuse for numerous papers by ethnologists, but it is a problem that still awaits solution. There is no doubt, of course, that like the American Indian he came originally from Eastern Asia, but where, in America, he developed his peculiar culture and the routes by which he dispersed remain a mystery. One quite plausible suggestion is that originally he was a forest dweller living somewhere north of Lake Superior, whence he moved north, probably encouraged by warlike Indian tribes in his rear, striking the coast somewhere between Coronation Gulf and Boothia Peninsula. From there the migration split, some going west, some east to Hudson Bay and the Labrador while others continued north-east through Baffin Island, North Devon Island, Ellesmere Island, over to Greenland and then south again down the west coast. It must be emphasised, however, that this migratory plan is largely surmise as many links in the chain of evidence are required before it can be regarded as proved.

Owing to numbers of varying factors, such as interbreeding with white men and different conditions of weather and hunting, Eskimos in various parts of the North differ considerably both in their appearance and mode of life. In Western Greenland from Disko Island southwards, the percentage of white blood is high and many of the inhabitants have fair skins and features almost indistinguishable from Europeans (except in a few cases—the offspring of some African negroes who were whaler's cooks). The short winter season has turned them into a race of fishermen rather than sealers. Around Coronation Gulf, there is alleged to be a tribe of 'blonde' Eskimos, comparatively tall, light skinned and fair haired people who may possibly be the descendants of an old Norse colony. On the whole, however, the Eskimo is a strong type and even though he may have quite a lot of white blood in his veins, he usually retains his Mongoloid characteristics. Differences in the Eskimo mode of life result from the fact that while his economy is usually based on the seal, abundance of other game such as caribou, walrus or whale may cause him to depend mainly on them for food and he develops a different technique for securing his livelihood. Thus it is quite impossible, within the scope of a lecture, to attempt a description of the Eskimos as a whole and the ensuing paragraphs will be limited to giving a brief outline of the life of the most northerly of the Greenland tribes—variously known as the Cape York or Smith Sound tribe or more picturesquely, the Arctic Highlander.

The Smith Sound Eskimo is the purest of his race and owing to his comparative inaccessibility has been the least contaminated

by 'civilising' influences. Physically, though far from being a pygmy, he is short and stocky, with a typically Mongolian face—high cheek bones, small slit-like eyes, small flat nose and a tendency towards prognathacity. As a rule, he is not a hairy man and though he wears his straight black hair down to his shoulders, his beard is thin and wispy and has a very undernourished appearance. His complexion is naturally sallow, but during the spring and early summer it is burnt almost black by the sun. He has a very attractive character, his most striking attribute being a perpetual cheerfulness under almost any conditions, whether of prosperity or starvation—an all too frequent alternation in his life. For the rest he is honest, truthful, loyal and courageous, qualities to which some Arctic explorers owe their lives and many others the success of their endeavours. He has remarkable mechanical aptitude and his intelligence is well up to European standards, though in the way of its development stands his happy go-lucky nature, complete refusal to look beyond the needs of to-day or to do anything but sit in the sun, talk or sleep as long as the larder is full.

The Smith Sound Eskimo lives on a barren coast line where there is little vegetation and no trees or bushes and as a rule little more than a $\frac{1}{4}$ to 1 mile of comparatively low and even country between the sea and the mountains behind; and a few miles further inland is the edge of that great desert, the Greenland ice-cap. Consequently he is dependent entirely on the sea for his livelihood and more particularly on the seal family. The common Greenland seal provides him with food, blubber for fuel and skins for clothing; the larger bearded seal supplies food, and its thicker skin, hide for dog traces, whips and harpoon lines; and the largest of the seal family, the walrus, is a source of dog food and ivory for making implements.

It is not proposed to detail here all his various methods of hunting but the principal ones can be mentioned briefly. Walrus and bearded seal are only killed in numerically small quantities and are usually shot while sleeping on the ice or else harpooned in the water, from kayaks. It is the common seal that occupies most of the Eskimo's hunting time, particularly during that period from the end of April to the end of June, when the sun is warm and the seals come up on to the surface of the ice to bask. These he hunts with rifle and seal screen, the latter consisting of white material stretched over a frame which he holds in front of him to hide him from his quarry. This form of stalking is a slow and laborious process and though in one day he may get as many as half a dozen

seals, on other days he will get nothing and he has to work long hours to get the scores that he requires to keep his dogs and family through the winter.

Narwhals, white whales and fish also serve to swell the Eskimo larder, but they are regarded as extras and are only obtainable in certain localities. Bird life, however, may form a substantial part of his diet, particularly little auks which fly close to the ground and are caught like butterflies, in nets. They are usually cached and left for a long period, until they are green with age and emit an aroma considered by the white man to be rather pungent. They are then regarded by the Eskimo as a great delicacy. The same applies to eider duck and sea gull eggs which are collected in enormous quantities and eaten when more or less rotten.

Finally there is the white and the blue fox which he traps during the winter, from November to the middle of March. Formerly regarded as a woman's occupation, trapping, next to his sealing, is the Eskimo's important occupation. No longer is the best hunter the wealthiest man in the community, but now it is the most cunning trapper since foxes are the only thing that white man requires of the Eskimo and consequently they are his only means of buying rifle, ammunition, tents, cloth, wood and others of the white man's products that he needs.

Like most hunting races, the Eskimo is a nomad ; he has to be, for game conditions may vary from year to year and he must go where his food supply goes. This does not mean that he is continually on the move, but it does mean that he often dies hundreds of miles from the place where he was born. Nowadays, however, there is a tendency for him to settle down owing to the establishment of trading posts, but ultimately the game in the vicinity of a post will be exhausted and he will have no choice but revert to the habits of his forefathers and move on to a better place.

The unit of his social life is the family, three or more of which constitute a village. During the winter, one or two families according to their size, live in one house, circular or square in shape and from eight to twelve feet in diameter. It is constructed by building a low wall round an excavation in the ground, banking it with turf and making a roof from skins and turf, supported by rafters of wood or whale bone. The doorway is usually about two feet high and is approached by a tunnel, built either out of rocks or else snow blocks. Inside, the house, which is about five feet high is paved with flat stones, which may or may not be covered with

peat or skins, and at the back is a raised portion—the sleeping bench where everybody sleeps in a row. The whole place is warmed and lighted by one or two seal oil lamps and usually gets so hot that the inhabitants sit about naked.

With the return of the sun—the end of February in the Smith Sound area—many Eskimos leave their village on bear or walrus hunts. This necessitates another type of dwelling, the igloo. This is too well known to need any description, but it should be pointed out that it is a snow, and not an ice, house as it is so often miscalled. It is built out of blocks of fairly hard drifted snow, two men being able to construct one sufficiently large for their needs in the space of an hour or an hour and a half. Usually an igloo is only sufficiently warm to be habitable for two or three nights since heating the inside results in its icing up, when not only does it become cold but also it begins to drip and wet all the belongings of the occupants. If the hunter wishes to remain in one spot for a number of days, he either builds a new igloo every other day or else initially makes a bigger one than he would ordinarily require and lines it with skins.

The coming of summer and the thaw creates another housing problem for the Eskimo. His permanent house has, during the winter become covered with snow drifts and as it was never intended to be water-tight, it is soon running with water and he has to move out. This he does by moving all his worldly possessions into a tent—either a seal-skin tupek, or a canvas tent bought from the store. Here he stays until the weather once more begins to get chilly, when he reconstructs his winter house and the cycle starts all over again.

No description of the Eskimos would be complete without an examination of the future prospects of the race. For a long time after his first contact with the white man, there was a danger that before many generations had passed, the race would be extinct. After centuries of living in an atmosphere completely free from germs, he came into contact with the diseases of civilisation and small-pox, venereal diseases, tuberculosis and even measles and influenza took their toll. Now, however, it appears that all the susceptibles have been killed off and the remainder have acquired some degree of immunity though in the Cape York area, 50% of all the deaths are still due to tuberculosis.

Although as far as intelligence is concerned, the Eskimo compares favourably with ourselves, he will never develop into a

thriving industrial race. As far as we know there are no resources in the Arctic awaiting development, so he will be forced to remain dependent on an uncertain luxury trade—fur—for the few comforts of civilisation that he can obtain. By some, this would be regarded as a gloomy future, but the Eskimo does not worry. He is far more contented than we, with our crowded cities and high speed life, can ever be. To the troubles of to-morrow he never gives a thought and if things go well he laughs and cracks a joke, but even if they are not so good, he still goes on laughing. Little though he has of this world's goods, he has a philosophy of happiness and what more could any man desire ?

The Distribution of Population in the City of Madras

By

GEORGE KURIYAN,
University of Madras.

When Day and Cogan founded the settlement of Madras in 1639, it was Hobson's choice for them and they had to choose a site which no body else would conceivably want. Day could probably have chosen San Thome, 'a fortified town of wealth and importance,' but he chose in preference a narrow strip of land north of San Thome with a shallow lagoon like river running parallel to the sea, at a distance of about a mile from the coast, which rendered the site easily defendable and which therefore seemed to him likely to prove an easier and more permanent holding.¹ The extent of territory occupied in 1639 was a tract about 3½ miles long, lying to the north of the mouth of the river Cooum, with a mean width of one mile. (Vide Map 1). By about 1645 Narimedu (Hog Hill) was included within the territory of Madras and gradually the outlying villages were assimilated. The first suburban village to be acquired was Triplicane ; there is no certainty about the exact date of its acquisition, but the year 1658 seems the likeliest on account of several reasons.² Egmore, Pursewaukam and Tondiarpet although acquired in 1693 were administered only from 1720. In 1708 the northern villages of Trivetore, Shaudium Kuppam, Ernavore, Kuttewaukauw and Aleundacheri were added to the territories. Perambur, Pudupet and Vepery were acquired only in 1742 and San Thome as late as 1749.

The extent of Madras in 1711 is indicated in Pitt's Map of Madras and it shows that even Triplicane was not directly absorbed into the city (Map II). Even as late as 1755, Pursewaukam, Vepery, Choolai and Veyasurpady had not become integral parts of the town as is shown by Conradi, in his map (Map III). The limits of Madras were fixed in 1798 when the Court of the Re-

1. See 'Growth of the City of Madras' by G. Kuriyan, Madras Tercentenary Commemoration Volume, page 295.

2. *Ibid*, page 302.

corder was established (Map IV) and they very nearly correspond with those of the present day except for Theagarayanagar (Mambalam) which came to be included within the city limits in 1923. The City of Madras has not grown up considerably since 1800 ; actually present-day Madras is larger than the Madras of 1798 only by the extent of territory it acquired in 1923 in Mambalam.

Madras has grown up on a strip of land of very tame topography about 9 miles along the coast and from 3 to 4 miles broad, presenting a uniformly flat appearance, the highest parts being 48' above sea level in Kilpauk and Mylapore. Madras Town is not markedly influenced by variety in geological conditions. The structure of the area shows alternating layers of fluviatile sands and clays to an average depth of 12'. Below 12', there is a stratum, 15' thick, of black stiff buttery clay with recent shells passing down into coarse marine sands. Gneissic bed rock is struck everywhere at about 57'. The subsoil consists of sand in the eastern half of the city and clay, or, sand and clay, mixed in the western portion. Large quantities of subsoil water are encountered within a few feet of the ground surface at all times of the year.³ The soil is a red loam with stretches of sand towards the coast along which there is a considerable body of sea sand travelling from south to north. This travel has been interrupted by the harbour which acts as a huge groyne and consequently there is now continuous accretion to the south and denudation to the north of the harbour.⁴

There seems little doubt that most of the area occupied by Madras was originally cultivated principally with coconut palms and paddy fields, the usual form of tank irrigation being employed.⁵ Although little used for the purpose of irrigation, many of these tanks still remain around the city. The Cooum and Adyar discharge water into the sea only during the wet season ; (November and December) for the rest of the year, the waters are stagnant. Originally perhaps the Cooum was organised to retain and utilize almost all the water falling on it. Now that this system of tanks and irrigation has lapsed, water often accumulates in undesirable places.⁶

3. Official Handbook of Madras 1933, page 108.

4. Report on Madras Town by H. V. Lanchester, page 10.

5. This is amply suggested by the following : Spur Tank, Nungumbau-kam Tank etc. Further evidence is found in Conradi's map.

6. In the centre and western portions of the town, the river Cooum forms the natural drainage channel and this may be linked up with the northwestern channel so that both may be carried to outlet sluices delivering into the outer harbour.

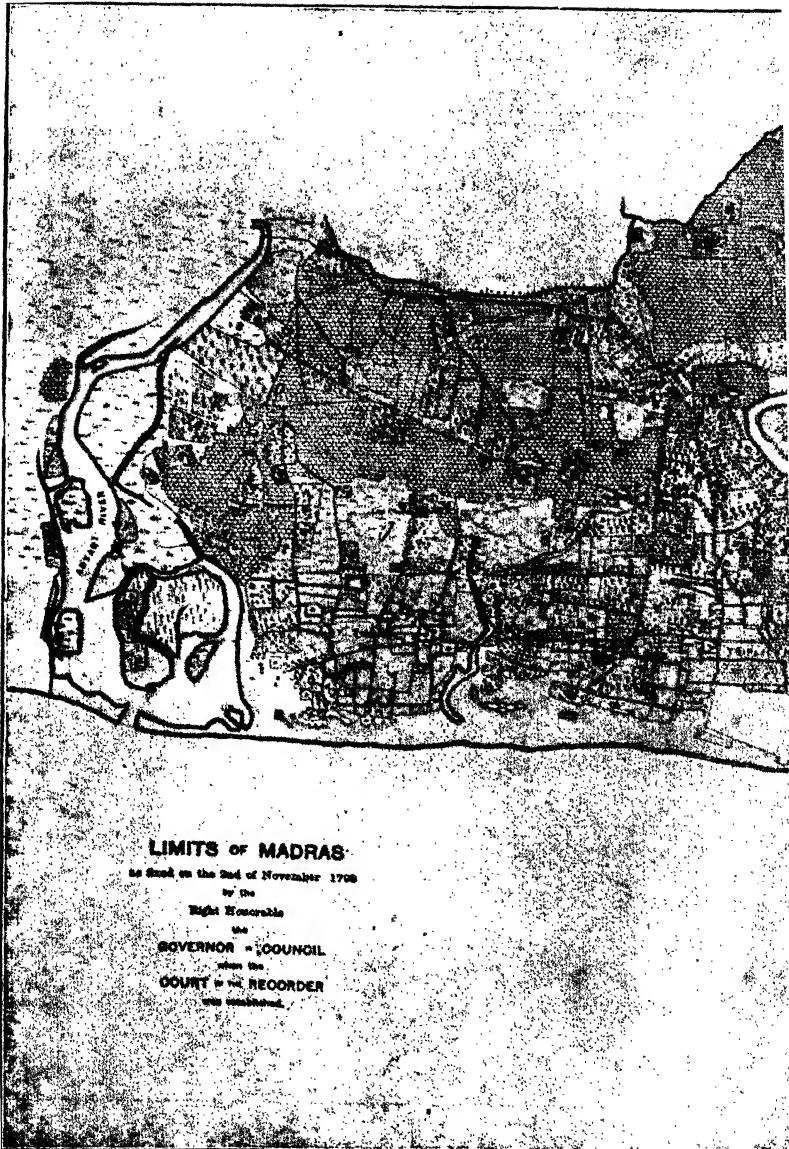
The area within the present boundary of Madras includes no less than three distinct towns,⁷ namely George Town, Triplicane with Chintadripet, and San Thome with Mylapore, while numerous other villages are distributed around these, according as land was found suitable or available for building purposes. To the west and south are the large houses with very large compounds and to the north and northwest are the large factories, while the un-occupied land is either cultivated or unused. The northwest area of the town lies so low that it is still largely undeveloped, in spite of its proximity to the industrial and commercial centres of the city and where portions have been occupied, the conditions are most unsatisfactory. Thus, immediately to the west of George Town is an area but little occupied, owing to its having been cut off by the railways and the Buckingham Canal, which have at the same time put difficulties in the way of surface drainage. If a really adequate scheme of surface drainage were provided, this district would become of immense value for extensions. (Vide Map VI).

It is thus seen that there is a large proportion of unutilised land in the Madras Town area. Apart from the central open spaces which have their value in respect of the congested districts around them, there are also stretches of ground that have ceased to be used owing to the abandonment of irrigation, but have not been rendered suitable for building sites or gardens for want of provision for the disposal of surface water. The tanks themselves form a large proportion of this area and in addition there are extensive compounds of which but little use is made and which are only needed as a protection to the houses they surround, against undesirable developments.

Growth and distribution of Population. An early computation of 1687 gave the population of Madras as 300,000 but this was obviously rather a guess than a count.⁸ In 1802, the population was calculated on the basis of consumption of grain and put at 600,000. The enumeration carried out by the Superintendent of Police in 1822, yielded the total figure of 462,051. An estimate in 1850, the basis of which is not known, suggested a total of 720,000. In 1863, Sir Charles Trevelyan who had been the Governor of Madras informed the Royal Sanitary Commission that the population of Madras City was not less than 1 Million! Based on a consideration

7. Census Reports of Madras 1871, page 67.

8. In 1763 it was estimated that the population was about 1 Million. See Maclean, 'Manual of Administration,' Vol. 2, page 92.



LIMITS OF MADRAS

as fixed on the 2nd of November 1708

by the

Right Honourable

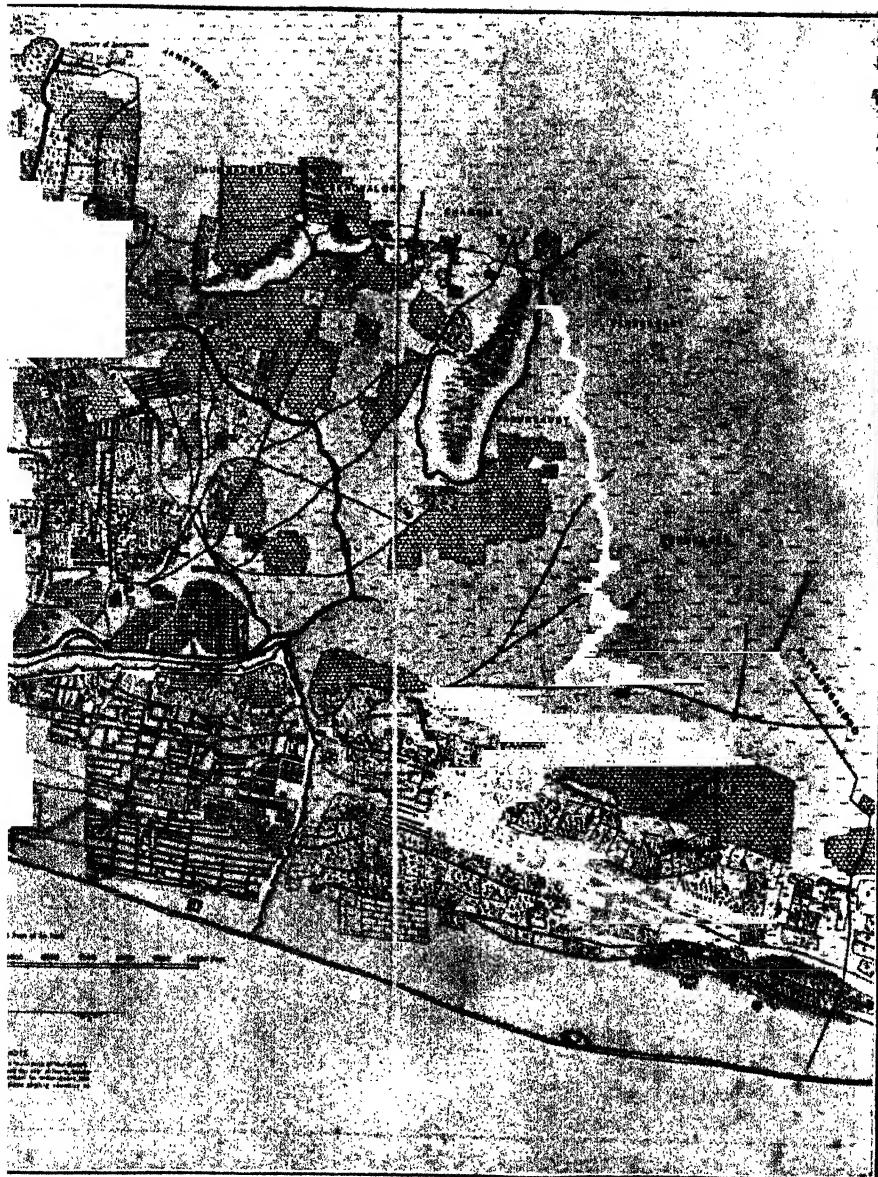
the

GOVERNOR - COUNCIL

when the

COURT in the REORDER

was established.



of the mortuary returns, Dr. Cornish in 1866 arrived at an estimate of 350,000. He however did not dare to adopt a figure so much below those previously accepted. But for this exception, every estimate of the population of Madras has been considerably over the mark.⁹ The first accurate Census of Madras was taken in 1871, when the population of the City was found to be 397,552.

In 1871, Madras was third in population among the cities of the British Empire excluding London, being only exceeded in population by Bombay and Liverpool, a city greater than Calcutta, Manchester or Birmingham,¹⁰ greater than Leeds and New Castle on Tyne put together—a city as great as Huddersfield, Halifax, Bradford and Hull all thrown into one—almost equalling in size all the cathedral towns put together, if London, Manchester and Bristol be excepted. It must be a marvel how such a city could have grown in so short a period and it is perhaps equally marvellous, that at the present day, all the other cities with which comparisons were made have out-grown Madras.

The following Statistics indicate the growth of Madras:—

TABLE I

Year	Population		Total Population	Hindu	Mahomedan	Christian
	Male	Female				
1871	194,676	202,876	397,552	330,052	50,964	15,626
1881	200,170	205,678	405,848	315,527 (77.7%)	50,298 (12.4%)	39,631 (9.8%)
1891	225,817	226,701	452,518	358,997	53,184	39,742
1901	256,730	252,616	509,346	410,648	57,331	40,958
1911	266,465	252,195	518,660	415,910	59,169	41,814
1921	276,107	250,804	526,911	427,722	53,163	44,136
1931	341,223	306,007	647,230	520,176 (80.4%)	70,031 (10.8%)	54,122 (8.4%)

9. These over-estimates of population were by no means peculiar to Madras. The population of Calcutta which was estimated at about 1 million was actually found in 1871 to be only 377,924 and Bombay with an estimate of more than 1 Million showed an actual total of 624,000. It is however interesting to note that in 1931 the population of the city of Madras was only 647,230.

10. Census of Madras 1871, page 16.

TABLE II

Year	Tamil	Telugu	Hindustani	Canarese	Malayalam
1881	239,396 (58.99%)	94,478 (23.3%)	46,426 (11.4%)	1,186 (0.3%)	— ..
1891	270,970	103,423	46,410	1,393	553
1901	318,993	108,496	51,032	1,947	804
1911	323,360	107,561	53,573	2,913	1,807
1921	336,553	104,117	46,528	3,272	4,093
1931	411,823 (63.6%)	124,649 (19.1%)	62,651 (9.7%)	4,539 (0.7%)	9,229 (1.4%)

TABLE III

Year	No. of Houses	No. of persons per house	Average density per sq. mile	No. of women per 1000 men	% growth in total population
1871	51,741	7.68	14,724	1042	—
1881	48,286	8.30	15,031	1028	2.1
1891	60,103	7.53	15,604	1004	11.5
1901	55,665	9.10	18,865	984	12.6
1911	59,595	8.70	19,210	947	1.8
1921	64,621	8.15	18,169	908	1.6
1931	73,845	8.79	22,318	897	22.8

Madras City is not highly industrialized and this lack of industries perhaps accounts for its slow rate of growth. It does not therefore provide conditions parallel to the other industrial cities of India like Calcutta. The demand for industrial labour is not so great and the proportion of immigrant labour which finds employment in the large organised industries is small. The small fluctuations in the movement towards the City cannot be accounted for entirely by the rise and fall of industrial demand.

The rate of growth of the city has been extremely low; during the last sixty years, it has not even doubled itself! The Statistics already cited show:—

- (i) a small growth in population for the period 1871-81;

(ii) a fairly even growth in population between 1881-1901; each part of the city registering an increase;

(iii) an almost stationary population during the period 1901-21 with a less regular internal distribution, the actual increase being noted in Perambur, Purusewaukum, Vepery, Kilpauk, Royapettaba, Egmore and Mylapore; i.e., the outer parts of the city; and

(iv) a very rapid growth in population since 1921¹¹ noticed in Tondiarpet, Perambur, Purusewaukum, Nungumbaukum and Royappetta.

It is however found that with low or falling prices of agricultural commodities, city growth is stimulated, while with rising prices, such emigration is generally retarded. During 1871-81, in spite of scarcity and famine in the Presidency, the increase in the city population was small "as a result of the rigid control of migration, combined with the relief provided in the rural areas by the operation of the famine code."¹² But for this, the city growth should have been much greater. In the period 1881-1901 when price levels tended to remain low, the rate of growth was more than 1% per annum resulting in a marked increase in the population of the city. In the period 1901-1921 when the prices were rising and when they soared high during the post-war period, the population remained almost completely stationary, showing a growth of less than 0.2% per annum. The volume of immigration strikingly diminished. During the period 1921-31 when prices dropped rapidly, the population increased enormously showing an average growth in excess of 2.25% per annum.

If the prices of the staple food crops of Rice and Ragi are considered, it is found that the city has grown least when the prices of these food grains showed a persistent tendency to rise. On the other hand, when prices fell down rapidly, the population of the city increased with considerable rapidity.¹³ It is therefore true to conclude that the growth or stagnation of the city was to a considerable extent directly dependent on the tendency of the prices to fall or rise. Rising prices may be due either to scarcity and famine or as a result of inflation. In the former case there

11. Census Tables of Madras. 1931, page 14. The increase of population over the decade (1921-31) was essentially an immigration feature, being illustrated by the quota of adults being well above that of 1921 and earlier years, despite the much stronger juvenile element.

12. Review of Madras Famine 1876 to 78 Pp. 25 et seq.

13. See Ranson 'A City in transition.'

is a definite stimulus to city migrations, while the latter offers a check to such movements. But when both the above causes operate simultaneously to enhance prices, the balance would normally be in favour of a reduced migration to the city.

Low or falling prices may be due to deflation or abundance. Generally deflation provides an enormous stimulus to migration towards the city while abundance as a consequence of a succession of favourable seasons renders agriculture—that work most congenial to the Indian villager—, both abundant and certain and hence would retard such movements.¹⁴ It is thus true to say that the migration which inflates the population of the city is one of despair rather than of hope!¹⁵

Madras is a city which from the beginning has grown up because of immigration and almost every report on the population of the city has clearly shown that the growth of the city is not natural, but due to accretion. Till 1931, the death rate in the city has always been higher than the birth rate.¹⁶ It is also noticed that there is a steady diminution in the proportion of women (Vide Table III, Statistics, p. 62) which cannot be accounted for satisfactorily. It is to a certain measure due to the temporary immigration of unmarried men into the city. The steady downward tendency is notable and is an indication of the extent of and nature of immigration contribution to the population. Madras has the lowest female quota among the cities of the presidency. Even in the predominantly residential divisions like Mylapore and Egmore, the proportion of women to men is low. Royapuram has

14. Census of India, 1911, Vol. XII, Part 1, Report, page 14.

15. Since writing this, I had a discussion with Dr. P. S. Lokanathan, Ag. Professor of Economics of the Madras University, about the exact relationship if any, between migrations to the city and prices of agricultural commodities. He was of the opinion that no relationship between these could be traced, (See Ranson, *op. cit.* for a contrary opinion) because the people who migrate to the city are generally not ryots but are invariably agricultural labourers, to whom variations in prices of agricultural commodities mean little, as they do not stand to profit or lose by such changes. In the absence of any definite statistics to show the type of immigrant into the city—whether he is a ryot or only a labourer—it becomes difficult to arrive at a definite conclusion on this issue.

16. The excess of births over deaths is noticed first, only in the decade 1921 to 1930 and the excess is a very small feature (only 544) and the city growth of 22.8% is far from being due to process of nature. "Madras is a city that grows by outside accretion." Vide City Census of Madras, 1931, page 3.

the highest female quota and is thus apparently the most residential ward in Madras.¹⁷ Yet it is not developing, probably because the area has suffered to some extent from erosion. Some houses may have been lost and nobody is likely to build on the ground overhanging the water-edge. But on going a little inland, there seems to be no reason why this ward should not improve, especially as it is not more unhealthy than the other neighbouring areas. It is likely that the poverty of communications accounts for the low growth.¹⁸ That this conclusion is justified is indicated by the growth of the northern unit in 1931. "The advent of the bus has probably contributed to encouraging people to settle more freely on the city margins. This applies more particularly to north Madras which was ill-served with cheap communications before the advent of the bus".¹⁹ The growth of the city in 1921 to 1931 is most marked in north, west and southwest. The west reflects the great industrial extension of Perambur and the south west, the Mambalam extension.²⁰

The distribution characteristic of the city in 1871 (Vide Map V) has been maintained till to-day, the main concentration of population being still around the fort. In 1871, the main centre of population was in Black Town (now called George Town) with another centre in Triplicane (including Chintadripet) with a third centre a distinct, but more sparsely populated unit occurring as a wedge between Chintadripet and George Town in New Town, Vepery and Pursewaukum. These centres formed a belt encircling *Fort St. George*. The other parts represented the outer belts of the city and were larger in area than the inner semi-circle. Each of them included large tracts of open and uncultivated land and the population was very unevenly distributed, the main concentration being around the scattered villages. As in 1871, so even to-day, Madras possesses extensive and largely undeveloped tracts (Vide Map VI) and thus enjoys a great advantage over other Indian cities like Bombay.

It is seen from a study of the religious composition of the population of the city (Vide Table I p. 61) that in 1881 the Hindus formed 77.7% of the total, the Muslims 12.4%, and Christians 9.8%. In

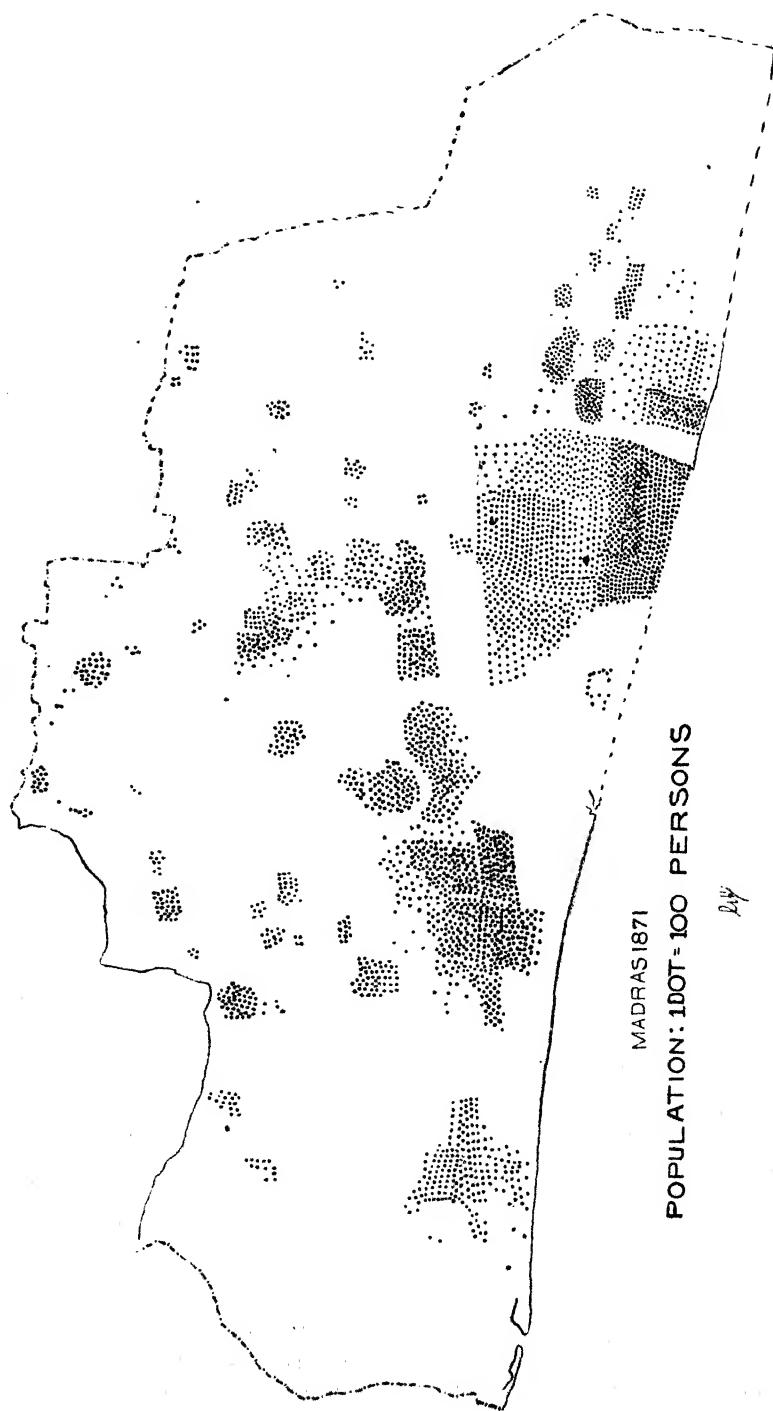
17. Has this anything to do with the distribution of Communities ? It is the most Christian of all the wards of Madras.

18. Vide *Molony*, City of Madras Census Statistical Tables 1911, page 4.

19. *J. C. Molony*, City of Madras, Statistical Tables 1911. Page 4.

20. It is too early to notice the effects of the S.I.Ry. electrification scheme.

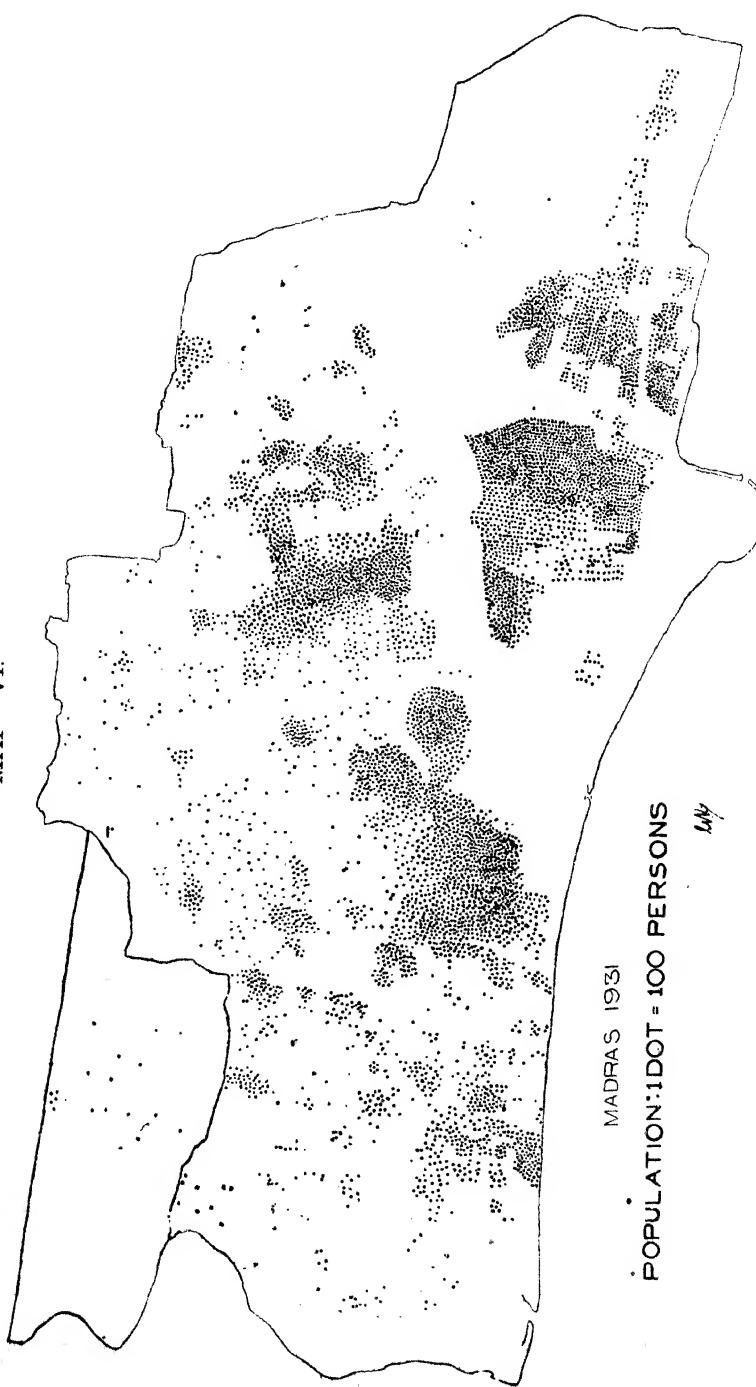
MAP V.



DISTRIBUTION OF POPULATION IN MADRAS

67

MAP VI.



1931 the corresponding proportions were 80.4, 10.8 and 8.4. The minority communities have thus not really grown at a rate faster than the Hindus.²¹ But the city percentage of the Hindus in 1931 is less than that of the Province as a whole and that of the Muslims and Christians is greater. This perhaps tends to illustrate the oft-quoted dictum that minorities generally favour towns!²²

A consideration of the language groups of the city population (Vide Table II page 62) shows that in 1881 Tamil was the mother-tongue of 59.0%, Telugu of 23.3%, Hindusthani of 11.4%, Canarese of 0.3% and Malayalam was not spoken in sufficiently large numbers. In 1931 the respective percentages were 63.1; 19.1; 9.7 and 0.7. In addition Malayalees constituted 1.4% of the total! It is therefore clear that Madras is steadily becoming more and more Tamilian, both Telugu and Hindusthani losing ground.²¹ However, the percentage of the Canarese speaking peoples has more than doubled while the Malayalees who formed 0.16% of the population only in 1901, now constitute about 1.4% of the total.²³

From a perusal of Table III it is seen that with increasing population, the number of houses has not proportionately increased, with the result that the average number of persons per house has been increasing rather than diminishing. It is approximately true to say that the wards of the city showing the highest numbers of occupants per house are huddled together in the centre, while the lowest figures are found in the out-lying divisions. This to a certain extent indicates the difference between the congestion of the centre and the spaciousness of the margins.²⁴

The maps of population (Maps V & VI) show very clearly that congestion is due not to scarcity of land but to failure in providing for an ordered city growth.²⁵ Several suburbs have better commu-

21. Identical conclusions are arrived at by calculating the percentages for the other census decades also.

22. Yeats 'City Census Reports,' 1931. Page 11.

23. *Ibid.*, page 12. "The ubiquitous Malayalee has clearly increased in numbers."

24. See. Ranson 'A City in transition' page 84.

25. On the same basis, population maps were prepared for all the census decades and they indicate identical trends and conclusions. They have however not been reproduced to illustrate the article, purely on considerations of economy.

nication with the city centre than the less accessible parts of the city itself and want of good access has militated against the natural development of suitable sites. It is also probable that the lower land prices and rates of taxation, together with the absence of building regulations in the outer suburbs, tend to promote developments which often take very undesirable forms. Land is sold and houses are built without proper provision for roads, sanitary arrangements etc. There is every likelihood of these suburban areas being assimilated by the growing city in years to come ; and if particular care is not taken to put them on the same footing as those within the city, they will develop into slums, thereby increasing the burden to be borne by the city.

"Though large parts are strictly urban, the city as a whole is in fact, rather a fortuitous collection of villages separated from the surrounding country by an arbitrary boundary line, than a town in the usual sense of the word. Some of the villages are rural hamlets to this day showing no sign of urban influence beyond the municipal lamp posts and dust bins with which their streets are dotted".²⁶ The 1871 Census of Madras showed that Madras was a conurbation made up of several distinct towns, each densely populated and a loose agglomeration of villages.²⁷ These descriptions are fairly accurate even today, though the improvements in the communications have welded the city into a more unified whole, blurring to some extent the fairly clear division between the several villages of former times. The density of population within the city varies remarkably; its average value has increased from 14,700 per square mile in 1871 to 22,300 in 1931 ; but the several wards of the city in 1931 had densities ranging from 175 persons to the acre in Ammankovil to 11 persons per acre in Royappetta ! Madras City though by far the largest in the province, is by no means the most congested.²⁸

The growth of Madras has taken place under circumstances so abnormal that comparisons with other cities are of less value than in most other cases. These circumstances have resulted in the formation of a number of subsidiary centres, in many cases too accidental to be mutually convenient. The administrative and

26. Imperial Gazetteer of India, Provincial Series 1908, Madras. Vol. 1 page 498.

27. Census Reports of Madras. 1871 page 67 and Ranson *Ibid* page 46.

28. Yeatts Census Tables for the City of Madras, 1931 page 5. "Madura is much more congested."

commercial functions of a large city demand more organisation as to locality than is at present found. The government and administrative buildings are widely scattered and the commercial centre around the harbour lacks good communications with the surrounding districts where many of those engaged reside.

Madras is a seat of Government, a commercial centre, an educational centre, and a social nucleus. All these ought to define themselves clearly in a city scheme. Although it is desirable to disturb as little as possible, it is none the less essential to endeavour to rectify the present accidental distribution of the buildings. The Government buildings are widely scattered throughout the town and there is no definite administrative centre, Fort St. George and Chepauk having almost equal claims. Education is a strong competitor for the Chepauk area and it is therefore desirable to move all the administrative offices of the government to Fort St. George. Within the Fort there may be no site suitable for large buildings, but around the maidan to the west and to the reclaimed area to the east of the Fort are lands lying unused. These could be utilised to a great advantage to house all the government offices.²⁹ The Gymkhana Club and the M.C.C. grounds could be given over to the educational centres for play grounds, parks etc. It is also important to consider the question of utilisation of the large estate of the Government House. In these days of fast motor transport and telephone communications, there is no particular advantage in the residence of the Governor being within a stone-throw of Fort St. George. The Government House at Guindy would be a better choice! With an intelligent corporation, much of the now unused lands could be utilised to the fuller benefits of the population at large.

29. Probably, during periods of war, it is not safe to advocate the construction of buildings on, or near, the sea front.

Regional Distribution and Relative Growth of the Cities of Tamil Nad*

By

N. SUBRAHMANYAM, M.A., L.T., F.R.G.S.

It is proposed to discuss in this paper the *regional distribution and relative growth of the Cities of Tamilnad* during the 60 years from 1871 to 1931 for which statistics are available and to draw therefrom certain interesting and important conclusions.

At the outset it is necessary to state that the term 'City' is used here in the sense in which it was used by the Government of Madras by applying it to towns under Class I and Class II of the Imperial Census Tables, which have a population of 50,000 and over, for which special statistics regarding age, literacy, birth-place and occupations are published at the desire of that Government and under its orders.

Tamilnad is that part of the Madras Presidency which is predominantly peopled by the Tamils. It consists of all the districts of the east coast plain, roughly south of the latitude of Madras. It excludes the District of Chittor, though the historic boundary of the Tamil country extended right up to the Venkata or Tirupati Hills thus including a part of that district. The Tamil districts are at the present day the following:—Madras, Chingleput, North Arcot, South Arcot, Salem, Coimbatore, Trichinopoly, Tanjore, Madura, Ramnad and Tinnevelly.

Within the region thus demarcated the *Census of 1931* showed 13 cities in the order noted in the two tables (Vide Appendix A). Four of them—Madras, Madura, Trichinopoly and Salem—come under Class I, each with a population of over 100,000; and it is interesting to note that these four cities are evenly distributed over each of the four sub-regions, which have also figured as the four historic divisions of the Tamil country, namely, Pallava (Tondaimandalam), Chola, Pandya and Kongu kingdoms.

Of the remaining nine cities, which belong to Class II with a population of over 50,000, *Tinnevelly (57,078)* and *Palamcottah*

*A paper read before the Association on 8-3-1941.

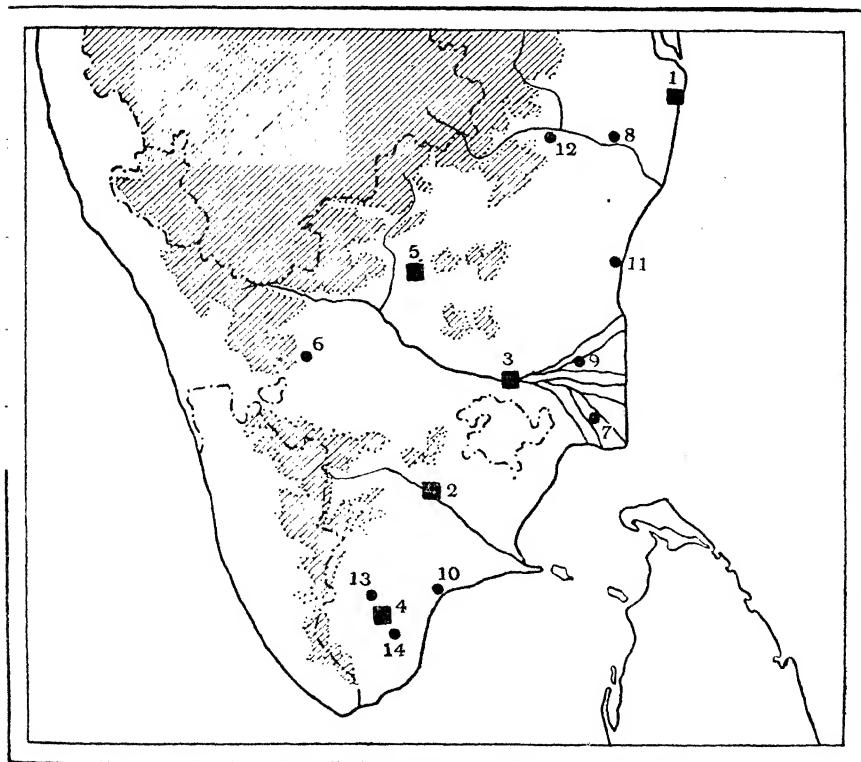
(51,990) occupy the last two places as they happen to be separate Municipalities. But as they are adjoining places, linked by a bridge over the Tambraparni which separates them, it is but proper that they should be treated for purposes of Census as one City (Cf. Calcutta and Howrah), as was suggested in the last Census Report for adoption in the Census of 1941, and not kept separate artificially simply because the two Municipalities do not desire to amalgamate and lose their individuality. If then these two cities are taken as one, there is revealed an interesting result that they are lifted up into a single City under Class I, as the united population comes to over 100,000 (109,068). Accordingly, in this paper, *Tinnevelly and Palamcottah have been treated as a single unit*—as the fourth city of Tamilnad, Salem being shifted to the fifth place. *We thus get 5 cities in Class I, each with population over 100,000 and 7 cities in Class II, each with population between 50,000 and 100,000 giving us a total of 12 cities of both classes for the Tamilnad.*

Let us next consider *their distribution* in the land. From a study of the map we find that all these cities are evenly distributed over all the districts, constituting the linguistic area, with the single exception of Ramnad District which goes without any city. This fact stands as a marked contrast to what is found in the Andhra country where six out of seven cities (1931) lie bunched in or near the deltas of the Godavary and the Krishna, the one exception of Vizagapatam being accounted for by its being an improved port with a considerable hinterland and the seat of the Andhra University. This even distribution of the Cities in the Tamilnad goes along with another interesting feature of it, namely, that the urban population and the number of towns of all classes are greater than in other parts of the Presidency. Mr. Yeatts, the Census Superintendent of Madras in 1931, quotes and confirms the remark made by J. C. Molony in 1911 that "the Tamil is more a town-dweller than the other Presidency races," preferring the busy life of the town to the comparatively dull life of the countryside.

Examining closely the distribution of the 12 cities, we find that 8 of them are the nodal centres in important and fertile riverine regions as follows:—the lower Cauvery basin—Trichinopoly, Tanjore and Kumbakonam; the middle and lower Palar—Vellore and Conjeeveram; Lower Pennar—Cuddalore; the Vaigai basin—Madura; the Tambraparni basin—Tinnevelly-Palamcottah. Of the remaining four cities, the coastal situation accounts for the two ports of *Madras and Tuticorin*, while Coimbatore and Salem on either side of the middle Cauvery basin have grown up as regional

centres in the old Kongu Country with certain peculiar advantages of position.

Before taking up each of these cities and tracing its individual and relative growth during the 60 years from 1871 to 1931, it will be helpful to note the *outstanding influences on the growth of population in each of the six decades*.



CITIES OF TAMIL NAD (census of 1931)

1. Madras, 2. Madura, 3. Trichinopoly, 4. Tinnevelly—Palamcottah,
5. Salem, 6. Coimbatore, 7. Tanjore, 8. Conjeevaram, 9. Kumbakonam,
10. Tuticorin, 11. Cuddalore, 12. Vellore, 13. Tinnevelly and 14. Palamcottah.

In the decade 1871-1881 there occurred one of the most severe famines of South India in 1877-78 which had left its mark in four districts of Tamilnad—North Arcot, Salem, Coimbatore and Madura. While the decade 1881-1891 was on the whole uneventful showing a general rebound of population after the great famine, the next decade 1891-1901 was "one of almost uninterrupted bad seasons" (Sir Frederick Nicholson), resulting in a general drift towards the town in search of employment, thereby leading to a

considerable increase of the urban population of the Presidency, by 25 per cent as compared with the 5 per cent increase of the rural population. In the decade 1901-1911 the prevalence of plague shows its effect in a decrease of population in certain cities like Salem and Coimbatore as a result of evacuation at the time of the Census. Similarly, in the next decade 1911-1921 the effects of the widespread epidemic of influenza in 1918 were perceptible in the decrease of population in certain cities in coastal districts, e.g., Tanjore, Trichinopoly, Kumbakonam and Cuddalore; and the low increase of 1.6 per cent in the decade in Madras. At the same time Salem and Madura showed the effects of plague scare. In the decade 1921-1931 urban population shows a considerable increase all over due to (i) general prevalence of good health, epidemics being rare, (ii) brisk trade after the Great War (iii) industry growing for the most part of the time, and (iv) communications developing greatly in the shape of branch and feeder railway lines as well as improved roads with regular bus and lorry services.

Having discussed the influences at work in the six decades, let us next examine the *relative position and growth of the several cities* one by one during this period, in order of population in 1931.

Madras has of course always held the first place as the Metropolis of the Presidency and as one of the major ports of India, with a population of 397, 552 in 1871 and of 647, 230 in 1931, showing an increase of 68.2 per cent which is nothing remarkable for its position and importance. It was only in the last Census (1931) that the City suddenly shot up with an increase of 22.8 per cent (while in the two previous decades the increase was only 1.6 per cent and 1.8 per cent respectively). This sudden rise in 1931 may be accounted for as follows:—(i) There has been a very marked industrial development as evidenced by the belching chimneys on its western approach; and new miscellaneous industries have sprung up such as the making of pencils, matches, beedies etc.

(ii) There has been an extension of a considerable growing garden city in the shape of Thyagarayanagar.

(iii) The improvement of communications within the town has helped considerably to greater settlement in the formerly rather inaccessible northern areas.

(iv) Several extensions have been growing up in the gaps of the City which was originally but a congeries of villages.

With the construction of the electric railway and the establishment of regular bus service to and from the City, the suburban

areas have considerably increased in population in recent years and if they are also taken into account, the Census of 1941 may show Madras in the ranks of the 'Million' Cities of India.

Madura has since 1901 been occupying the second place in the Presidency, while before that date *Trichinopoly* was holding that rank. With a population of only 51,987 in 1871, the city had, in 1931, 182,018 persons, which yields a high percentage of 252, in 60 years. The decennial increase was 31 per cent in 1931, though in 1921 the City suffered somewhat from exodus caused by plague scare with a low decennial increase of only 2.8 per cent. 20,000 residents are said to have left the town on this account.

A famous historic capital of the Pandyanad, a regional centre of the Vaigai basin, a well-known shrine and a great centre of an indigenous dyeing industry, *Madura* has also the external appearance of a large city, visible as the train steams into it from the North. The *Periyar Irrigation Scheme* has had its influence in the large influx of the bigger landowners who have settled in the City coming from the different parts of the District; and as a pilgrim centre there is a periodical as well as a perennial influx of floating population. But the recent striking increase of its population is undoubtedly due to industrial development, especially in the line of weaving—"an inference," said J. C. Molony even in 1911, "strengthened by the reversal of the sexes during the decade (999 females to 1000 males). The City has one of the largest spinning mills; and during the decade ending 1931 others have sprung up. Consequent on the advent of mill labour there has been an increase of trade of all kinds, which was further helped by railway extension. A large educational centre with two colleges and several high schools, the City also serves as the Headquarters for the two districts of *Madura* and *Ramnad*. The further increase of the population of this City is likely to be marked and continuous.

Trichinopoly which held the second place in the Presidency till 1901, slipped to the third place by *Madura* outstripping it in that year, leaving it far behind. In the 60 years between 1871 and 1932 the City has shown only an increase of 86.6 per cent as against the 252 per cent increase of *Madura* during the same period; and its decennial rate of increase was far lower than that of *Madura*. In the Census of 1921, the City actually showed a decrease of 2.5 per cent over the previous census (due no doubt to the prevalence of influenza in 1918); while in 1931 it recovered and showed only an increase of 18.6 per cent.

Trichinopoly is a town of great historic antiquity like Madura with Woriur, a Chola capital as its suburb. Though it possesses no special industry, it has several miscellaneous manufactures such as hand-weaving, metal-work, ornamental silver-ware, cheroots, carpets, tanneries, shoes etc. It is a great centre of trade, a very important railway junction and the headquarters of a considerable railway system—the S.I.Ry. It is also a nodal centre of roads, with important road bridges over the Cauvery and the Coleroon on the Madras Trunk Road. There is a cantonment at Trichy. Besides its administrative importance, Trichinopoly is a bigger educational centre than Madura.

Itself an important temple-town Trichy has in its neighbourhood, across the Cauvery bridge, the great pilgrim centres of Srirangam and Tiruvanaikkaval, the former a Municipality.

The South Indian Railway Colony of Golden Rock in the vicinity of Trichy, with Workshops for both broad and narrow gauge lines, has a peculiar interest for the City as adding to its importance, if not directly to its population. Negapatam where the Workshops were formerly located was pulled down by this transfer from the position of a City under Class II to that of a town under Class III; and distant Podanur also felt the echo of it. "The Government of this Colony is in the hands of the Railway; and with its shaded and well-laid-out streets, neat houses and attractive appearance, it might serve as an example to South Indian Municipalities."

—M.W.M. Yeatts (1931). With its population of 13,000, it was no mere growth but a creation, whose effects have been felt as stated above from Negapatam to Podanur. It is interesting to note that if the Golden Rock Colony and Srirangam are included in Trichinopoly, their population come up very nearly to that of Madura.

The twin cities of *Tinnevelly* and *Palamcottah* linked by a road bridge on the Tambraparni, like Calcutta and Howrah or Buda and Pesth, each with a population of 57,078 and 51,990 respectively give a total of 109,068, pushing Salem down to the 5th rank in Class I. Nothing but the opposition of the two Municipalities stands in the way of their amalgamation; and as the Census Report of 1931 has itself suggested their being treated as one urban unit in 1941, "though they retain their separate existence and rivalry," it is preferred to treat them as one unit in this paper also. The headquarters of the Tinnevelly District, they form also the regional capital of the fertile middle basin of the Tambraparni, and an important route centre with roads and railways radiating in all directions.

Taking the population of the two cities together, we find that it has grown enormously in 60 years, from 38,989 in 1871 to 109,068 in 1931—an increase of 179·7 per cent during the period, which is reflected more or less similarly in the growth of the two cities separately also—Tinnevelly 171·2 per cent and Palamcottah 189·7 per cent. The sudden leap forward has been indicated in the beginning of this century in the Census of 1901, when the decennial percentage of increase was found to be as high as 84·1. This is no doubt due partly to the inclusion of additional areas within the city limits as stated in the Census Report, but must also be attributed to general prosperity, growth of trade, freedom from epidemics like plague, influenza or cholera, and improvement of communications.

Salem, the last of the cities of Class I, has risen from 50,012 in 1871 to 102,179 in 1931, thus more than doubling itself (104·3 per cent) in the 60 years. More interesting to note is the remarkable decrease of population at two intermediate censuses:—18·2 per cent in 1911 and—11·7 per cent in 1921, as the result of plague scare and evacuation at the time of taking the census. When therefore normal conditions of public health were restored, the census of 1931 has shown the considerable increase of 95·6 per cent (almost doubling itself) in the decade, thereby bringing the city into Class I for the first time. Mr. Yeatts suggests that a succession of poor monsoons drove the labourers into the town in search of work, as is evidenced by the clusters of huts in and around the town in recent years. Moreover the cloth trade was flourishing till recently and attracted an unusual number of weavers. The construction of the railway to Cuddalore through the Attur gap may have helped to some extent in the growth of trade in the city; while the magnesite industry has contributed its share to the increase. It is doubtful, however, if Salem will be able to keep up its place in the next census and show a continuous increase.

Coimbatore is the first city under Class II in the Tamilnad that is sure to get into Class I in the next census and most probably far outstrip Salem. With a population of 35,310 in 1871 and of 95,198 in 1931, the city has more than trebled itself in 60 years an increase of 169·6 per cent. The increase was steady, though not high, in the first three decades; and at the census of 1911 there was a setback—a decrease of 11·4 per cent due to evacuation of the city on account of plague scare at the time. It was at the last census in 1931 that a fairly high increase of 44·7 per cent in the decade was in evidence, showing that the city was beginning to take a leap forward after its recovery.

Everything is in favour of Coimbatore's increase. Historically it was a place of high strategic importance, commanding the Palghat Gap in the west and covering the Hasanur Pass in the north. It possesses a very pleasant and healthy climate, and has been free from epidemics since 1911. The centre of a considerable trade, the city has been having a number of miscellaneous industries such as coffee works, oil presses etc. Its position on the edge of a large cotton-growing area has led to the growth of cotton mills, which now number over 25 in and near the city. This rapid growth has no doubt been helped by the great advantage that Coimbatore possesses of being the nearest city from Pykara power station. To cope with the rapid growth of the city, several extensions have been formed; and the railway station is being remodelled as a great junction, practically taking the place of Podanur. This rapid progress of the city is sure to be kept up for some time; and it is expected that it will not only get into Class I but will far outstrip Salem in the next census.

The next three cities of Class II, *Tanjore, Conjeeveram and Kumbakonam*—present a type largely of residential towns that seem to have reached very near the limit of their expansion. During the 60 years their respective increase has been only 28.2 per cent, 74.8 per cent and 40.2 per cent. The entry of a fresh factor may give them a momentum for a fresh leap forward; but as it is they have reached a relatively stationary stage.

Of these three cities, *Tanjore* has had the smallest increase in 80 years (28.2 per cent) with a slight decrease also at two previous censuses, the highest decennial increase being only 11.6 per cent in 1931. The 4th largest town of the Tamilnad in 1871, *Tanjore* has slipped down to the 7th place in 1931. Though the headquarters of the District, the city has no important industry, except those connected with the old Rajah's court. In fact, *Tanjore* seems to have declined since the death of the last Rajah in 1855, who though only titular, attracted to his court all professions. Their dispersal commenced with the death of the Rajah; and it became more rapid since the demise of the Princess his successor.

Kumbakonam, situated in the middle of the Cauvery delta with its increase of 40.2 per cent in 60 years, has been running more or less the same course as *Tanjore* in the matter of population growth; overtaking it in 1901 as the 6th city in Tamilnad and rising to the 5th rank in 1911; but it was outstripped by *Tanjore* in 1931, after the set-back of the "influenza" census of 1921. Though *Tanjore* is the headquarters of the District, *Kumbakonam* has shown a

higher and steadier increase (except of course in 1921) due to its conspicuous position as an educational and religious centre.

Conjeevaram is another town of the residential type like Kumbakonam and is a place of religious importance containing temples which are the objects of constant pilgrimage. The decennial increase of population of this city has been steady without any set-back due to epidemics, showing an increase of 74.8 per cent for 60 years as against the much lower increase of Tanjore and Kumbakonam. This city is situated in the middle of a fairly fertile stretch of country; and "possibly part of its expansion is due to a growing tendency amongst the larger land-holders to forsake their villages for the greater convenience and comfort of life in a town." G. T. Boag (1921). It was the regional capital of the lower Palar basin through the ages, known as Pallavanad or Tondaimandalam; but after the rise of Madras it had to take a subordinate place as its satellite. Hence, unlike Kumbakonam, it has not grown into a great educational centre, despite its cultural traditions. It has, however, a flourishing handloom industry.

Tuticorin is the second port in Tamilnad, coming next after Madras. Its growth has been unrivalled and phenomenal in the last 60 years, from 10,565 in 1871 to 60,395 in 1931—an increase of 471.7 per cent. Before 1861, Tuticorin was an insignificant port, even less important than Kulasekharapatnam or Kayalpatnam; but the export of cotton from its hinterland during the American Civil War and after set it on its path of prosperity in which it has since continued to progress steadily as the outlet of the cotton lands of Madura and Tinnevelly Districts. The port is also a terminus of the South Indian Railway. The 35 per cent decennial increase of the last census (1931) is attributed partly to some adjacent areas having been brought within the municipal limits during the decade, partly to the general increase of population within the district, and partly also to the fact that since the provision of good drinking water the town is becoming a seaside residential resort for the Nadar merchants of the cotton lands behind it.

Cuddalore (59,057) and *Vellore* (57,265) bring up the rear in the list of cities of Class II in Tamilnad. The headquarters of South Arcot and North Arcot districts respectively, these two cities have been running an almost even race with their individual vicissitudes showing an increase of 46.6 per cent and 51.6 per cent respectively in 60 years.

Cuddalore is an important trade centre, which had suffered a 10 per cent decrease of population in 1921 census due to trade de-

pression and to the epidemic of influenza in 1918. The provision of railway communication westwards through the interior of the district to Salem has helped somewhat in the increase of its trade, as is evidenced by the decennial increase of 16.9 per cent for the city as against the 5.4 per cent increase for the district as a whole.

The growth of *Vellore* was rather slow; and the town became a 'city' under Class II with just over 50,000 persons only at the census of 1921. Since the famine of 1877-78 a very large trade in grain has developed in the town; but its disadvantage of being 4 miles from the railway (M.S.M.) has been made up for by the construction of the S.I.R. line. A historic town at the crossing of two important natural routes—one north-to-south and the other east-to-west, *Vellore* saw its trade steadily increase in the succeeding years; and recently it has become a big centre of bus traffic.

Summary and Conclusion.

From the foregoing discussion and examination the following conclusions may be formulated:—

- (1) That the cities of Tamilnad (with a population of over 50,000) are found to be evenly spread out over almost all the districts of it without being unduly bunched together in any area.
- (2) That the cities of Class I (what may be called lakh cities) are also distributed evenly as regional centres in the historic divisions of Tamilnad—Tondaimandalam, Cholanad, North Pandyanad, South Pandyanad and Kongunad.
- (3) That Madura, Tuticorin, Coimbatore and Tinnevelly-Palamcottah have shown remarkable rise in the 60 years from 1871 to 1931.
- (4) That Coimbatore, with power from Pykara, has grown to be the Manchester of South India, and bids fair not only to show itself as a lakh city in the next census but also to outstrip Salem.
- (5) That Tanjore, Conjeeveram and Kumbakonam have reached the limit of their expansion, any may not show any marked increase of population unless new factors arise to influence them.
- (6) That Cuddalore and Vellore have remained the last two cities in rank, owing to the absence of any great industry in them but depending mainly on trade as collecting and distributing centres for the surrounding country.
- (7) That Madras had a fairly good increase of population only in the last census (1931), while its net increase was nothing remarkable for a metropolis of a large province.

Before concluding, it may be of interest to guess and forecast which of the towns of Class III in Tamilnad are likely to get into the rank of cities of Class II at the next census in 1941. It is very probable that *Negapatam* (48,527 in 1931) which held that position all along, but lost it at the last census as a result of the transfer of the S.I.R. Workshop to Golden Rock, may easily recover that place, being very near the limit. *Dindigul* (43,617 in 1931) which has been growing rapidly in trade after the construction of the railway to Palni and Pollachi, may also enter the rank of Class II. But no other town of Class III holds out such a promise. The Census of the present year should show how far the prognostications made in this paper would prove true.

Finally, it has to be stated that the growth and decline of cities and towns are not mere statistical phenomena ; the cause and effect of every factor, political and economical, that affect the phenomena should be studied, and these change with each epoch. In the case of several towns, it may be pointed out, that the conditions of growth are often provided by governments that choose them as capitals and headquarters.

Moreover, mere growth of towns in population may not in itself be a matter of congratulation, unless public conscience is also worked up to the necessary limit, as they are often allowed to grow haphazard without sanitation being properly cared for, the vested interests of capitalists being sometimes arrayed in opposition.

APPENDIX A

Table showing the Growth of the Cities of Tamilnad from 1871 to 1931

No.	Name of the City.	Census of 1871.	Census of 1931.	Census of 1921.	Census of 1911.	Census of 1901.	Census of 1891.	Census of 1881.
1	Madras.	397,552	647,230	526,911	518,660	509,346	452,518	405,848
2	Madura	51,987	182,018	138,894	134,130	105,984	87,428	73,807
3	Trichinopoly	76,530	142,843	120,422	123,512	104,721	90,609	84,449
4	Tinnevelly- Palamcottah	38,989	109,068	100,426	89,714	80,014	43,454	41,285
5	Salem	50,012	102,179	52,244	59,153	70,621	67,710	50,667
6	Coimbatore	35,310	95,198	65,788	47,007	53,080	46,383	38,067
7	Tanjore	52,175	66,829	59,913	60,341	57,870	54,390	54,745
8	Conjeevaram	37,327	65,258	61,376	53,864	46,164	42,548	37,275
9	Kumbakonam	44,444	62,317	60,700	64,647	59,673	54,307	50,098
10	Tuticorin	10,565	60,395	44,522	40,185	28,048	25,107	16,281
11	Cuddalore	40,290	59,057	50,527	56,574	52,216	47,355	43,545
12	Vellore	38,022	57,265	50,210	49,746	43,537	44,925	37,491
13	Tinnevelly	21,044	57,078	53,783	44,805	40,469	24,768	23,321
14	Palamcottah	17,945	51,990	46,643	44,909	39,545	18,686	17,964

APPENDIX B

Table Showing the relative rank and decennial variation of population in Tamilnad from 1881 to 1931

No.	Name of the City.	Census of 1931	Census of 1921	Census of 1911	Census of 1901	Census of 1891	Census of 1881
		Rank	Variation	Rank	Variation	Rank	Variation
628	1 Madras	I	+22'8	I	+1'6	I	+12'6
252	2 Madura.	II	+31	II	+2'8	II	+26'6
866	3 Trichinopoly	III	+18'6	III	-2'5	III	+17'9
1797	4 Tinnevelly Palamcottah	IV	+8'7	IV	+11'9	IV	+12'1
1043	5 Salem	V	+95'6	IX	-11'7	VII	-16'2
1696	6 Coimbatore	VI	+44'7	V	+9'3	XI	-11'4
282	7 Tanjore	VII	+11'6	VIII	-0'7	VII	+4'3
748	8 Conjeevaram	VIII	+6'3	VI	+13'9	IX	+16'7
402	9 Kumbakonam	IX	+27	VII	-6'1	V	+8'3
4717	10 Tuticorin	X	+35'7	XII	+10'7	XII	+43'3
466	11 Cuddalore	XI	+16'9	X	-10'7	VIII	+8'3
516	12 Vellore	XII	+14'1	XI	+0'9	X	+14'3
1712	13 Tinnevelly	XIII	+6'1	IX	+4'3	XII	+10'8
1897	14 Palamcottah	XIV	+11'5	XIII	+3'8	XIII	+13'6

to 1931.
from 1871.
Variation
%
to 1931.

Modern Methods in Teaching: the Variety of Interest that Geography Can Give*

By

MISS J. M. GERRARD, M.A.

Geography is a subject that develops in one something of the insatiable curiosity of the *Elephant's child*, and because it touches life at so many points it carries one along on a never-ending quest of discovery. Let me give you a personal experience as an illustration; it was in connection with the recent presidential election in the United States. Now I could never understand the difference in American politics between a Republican and a Democrat, nor remember (when I wanted to) which was represented by whom—until I noticed there seemed to be something geographical in the grouping of the votes—just why for example was the South expected to vote Democrat and the East Republican? Here was a problem to be solved and after diving into several volumes of the *Encyclopaedia Britanica*—I emerged with the answer, and, moreover, with a more or less well defined outline in my mind of the significance of these terms, and an enriched background of the geography and history of the United States. This I think is one of the attractions of the subject, it gives side-lights on so many things and is always opening up vistas to the mind.

The joy and satisfaction that derives from discovery depends upon the extent to which it is a personal quest; in other words the search for information and for facts must be made part of the individual's experience. Geography is a subject, like Nature Study, that provides splendid opportunities for personal discovery, even in school. Let me give an example. Most children are interested in ships and the sea, and they find absorbing all sorts of details which the grown-up person may think unimportant but which for them are necessary steps in enriching their background of ideas. One school conceived the brilliant idea of "adopting a ship," of tracking its movements through the shipping news in the daily newspaper and charting its voyages upon school maps. The

*Courtesy of A.I.R., Madras: A broadcast talk to teachers given on 11-1-1941.

children wrote letters to the officers and crew and asked questions about things that puzzled them, and you may be sure their questions required a knowledge of details far beyond the experience of the poor geography teacher. And, as it happened, the officers and the crew played their part with zest. They wrote living descriptions of the places they visited, they explained the technicalities and hazards of navigations, they even sent specimens of cargoes, where this was possible, for the school geographical museum. Now the voyages of a tramp steamer cover the great trade routes of the world, and in this way the children learned about places, about commodities that form the basis of world trade; they learned moreover first-hand about trade-winds and monsoons, and how to find latitudes and longitudes (or to use the dramatic nautical expression how to "shoot the sun"). Thus the children were led along many paths to knowledge and many new activities were started—for example some boys were stirred to such enthusiasm that they began to draw up meteorological graphs of their own, from the current weather reports. This experiment proved so fruitful as a centre of interest that other schools followed suit and within a year or two a Ship Adoption Society was started and by the end of the year 1937, the officers and men of over 500 ships in the British Merchant Service were teaching Geography to 250,000 boys and girls of all grades. Other countries have since adopted the idea—and, in passing it is not without interest to note that Germany was the only one to make the adoption by decree and not voluntary, thus losing the educational value of the method. It is true that India has not, as yet, a mercantile service of her own to draw upon but she has equal claims on the British Mercantile Service that transports her cargoes to the uttermost ends of the earth, and there is no reason why we should not develop the scheme in this country.

There is too a realism about geography that makes a very great appeal to children at all stages. They are naturally interested in matters that belong to the life of the community. "Teacher is talking about things that we hear of outside school" they say taken by surprise and the lesson suddenly comes alive. I once read an interesting account of the reactions of pupils in an experiment which set out to bring actuality into the school. The aim was to learn about the work and life of the people who served the community. And so the local postman and the fireman and the milkman and sewerman and many others came to school and talked with the children and then the class was taken to visit the scene of their work. The children of course were thrilled—imagined

their faces as the fireman walked into their class room in his shining brass helmet carrying his spanner and his axe! They bombarded him with questions—it was surprising to see how penetrating their questions were, what a valuable amount of information they gained, what a wealth of experience they were deriving from these personal contacts. Not only were they mentally stimulated but these contacts awoke their sympathy and aroused their social consciousness. Why not carry this idea into the upper school and invite into the class room workers in various departments that serve our City!

Like Nature Study, Geography should vary in garb according to the locality—its urban expression is necessarily different from its rural expression. In other words, the Geography course should be coloured by the environment—although at the same time it must look beyond it—for here is to be found the real measure and illumination of conditions elsewhere. And the experiences children get from this *direct study of the concrete* play an important part in stimulating their imagination and enriching their store of ideas. It is here that the most worth-while projects can be developed which, carried out through the method of group work, provide opportunity for a variety of geographical activities. Take for example a project of local agriculture—this would include a study of the present distribution of cultivation in relation to water supply, the products and the methods, rotations, times and implements associated with the various activities of the cultivator. The material collected would be presented in the form of written descriptions, drawings and plans, with an investigation into the past, making maps of the vestiges of old fields, wells and ditches and grazing ground, particulars of old implements now passing out of use, old sayings, the local names for crops, growing times and details of festivals associated with the local agriculture. Other projects could be developed out of the bazaar, and local industries etc. A more ambitious study of the home area is the regional survey, a fascinating method that brings out the real unity underlying geography, nature study and history.

Then there is the appeal to the imagination and sense of adventure in stories of discovery and exploration. Unfortunately however there is little material here appropriate for the pupils in Indian schools, not only because of the language difficulty but because the heroes and the background of such stories are not Indian. Presently there will arise I hope an Indian Ballantyne and we shall have thrilling stories about the true adventures and

perilous journeys of Pundit Kintap and the other Indian explorers, whose courage and endurance and resource are worthy to be enshrined in epics.

There is no time to talk about the special appeal that Geography can have for the practical child, and the backward child and the scientifically minded child, nor of the appeal that maps can have for all. But certainly Geography gives scope for an infinite variety of approaches if we but have the courage to step off the beaten track for one lesson out of every three. The words of Sir J. Arthur Thompson are equally applicable to the Geography teacher as to the Botany teacher. "All roads" he said, "lead to Rome and what we wish to develop is not so much knowledge as a lively interest, a scientific way of looking at things and some joyful appreciation besides."

A Historic Meeting Ground : Satyamangalam

By

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The District of Coimbatore is unique in the history of the Tamils of South India, since it commands the key to the central boundary line that separated the three great Tamil Kingdoms and Mysore. It was the bone of contention among the neighbouring belligerent kingdoms and more than once it has suffered terribly at the hands of the conquering invaders. It came under the sway of the Cheras in the early Christian era and it has been, though with some uncertainty, held that Karur was their Capital. The District has been designated as Kongunadu or Kangayanadu, whose limits went up to the trijunctional point, on the banks of the river Karaipottanar, a river entering the Cauvery at about eleven miles east of Karur. Almost all the Tamil poets agree as regards the limits of the kingdom and Auvai (ஒளவை) has cited the following regarding the boundary of the kingdom. “ வடக்குத்தலம் பழநி, வாழ்க்கூக்குச் செங்கோடு, குடதிசைக்குக் கோழிக் கூடாகும், கடற்கரையினேரம் அது தெற்காகும் ஒரெண்பதிங் காதம் சேரநாட்டெல்லை எனச் செப்பு ” One has to infer from this that the present District of Coimbatore and Salem came under the sway of the Cheras.

But History is a record of the rise and fall of kingdoms. And so, in the tenth century A.D. there was a Chola revival under Aditya and Parantaka and consequently the District passed into the hands of the Chola rulers. In an Inscription on the western wall of the Uthra Vira Ragava Perumal Temple, within the fort at Dharapuram, it is recorded that, during the reign of a Kongu Chola by name Tribuvana Chakravartin Vira Rajendra, a gift of a stretch of land for rice offerings to the Goddess Perun Karunai Selviyar had been made. This inscription is registered as number 148 by the Archaeological department. This proves beyond doubt that the Kongu Cholas held sway for a considerable period over the District. There seems also to be much truth in the recent historical finding that the District next passed on to the hands of the Pandyas, as is borne out in other inscriptions recorded as 151 and 152, (to be found in the

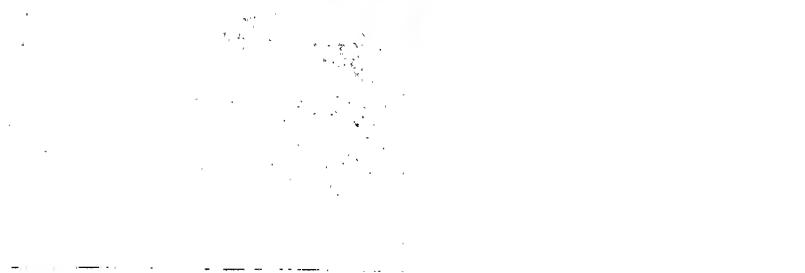
south Prakara of the same temple) to the effect, that, during the reign of the Kongu Pandya, Vira Pandya Deva, a gift of certain ceiling stone beams and pillars to the Pillayar Temple had been made.

During the 15th Century the Vijayanagar monarchs held the mastery over the south and with their decline, the Naiks of Madura became masters of the District in the Sixteenth Century. Two inscriptions, registered as Numbers 145 and 149, mention one Vira Pratapa Sadasiva Deva Maharaya as the ruler of Kongunadu during the last quarter of the 15th Century (Saka Era). But the 17th Century was a critical period in the annals of the District when there were a series of incursions, ending in numerous battles, by the Mysore rulers, which ultimately terminated in the District forming part of Mysore territory. But the District saw no quiet or rest, since a series of bitter fightings ensued between Hyder and the British. In the last war with Tippu, when the brave ruler died, the whole of the District was ceded to the British.

It is not so much the history of the District as the remnants of the forts and buildings constructed by the various rulers, in some of the outlying localities of the District that demand our attention. Being of easy approach from Mysore through the Gazelhetty, the Hassanur and Talamalai passes, the District has an entrance in Satyamangalam, a place on the bank of the river Bhavani, and a former head-quarters of the taluk. It is a commercial gateway from Coimbatore to Mysore. Through that locality numerous hordes of Mysore troops poured in, into the District, under Tippu. They passed through the Gazelhetty Pass though now it has been abandoned in favour of Hassanur Pass. A bridge on the river Bhavani is at the entrance to the town. The same river serves as the southern moat to a very big fort, with rampart walls, of clay and granite, surrounding it. There lived a branch of Tirumal Naik's family, in all probability a son-in-law of his, who was entrusted with the arduous task of guarding the northern entrance into the District, with special instructions to see that the Mysore incursions were effectively checked. The fort had moats surrounding it, and to this day we can see an inlet from the river into the eastern moat, to provide for an easy filling up of the moats with water from the river. The forts and moats are now in ruins though the southern wall, with the prickly pears richly grown, are to be seen to this day. The temple at the centre of the fort underwent the ravages of time and the deity has been removed to the western corner of the village and to differentiate it from the main temple



Kottai Perumal Temple.



**The Arsenal in
Ruins.**



Bhavani Bridge.



of the village, this temple is called Kottai Perumal Temple. The Arsenal is there in ruins in the south-east corner of the fort.

The area seems to have been once populous, as is evidenced from the fact that it was once the headquarters of the Taluk and as it commands, even now, the entrance into the District from Mysore. The lingayats abound in the locality and that is a clear proof of the frequent intercourse between Satyamangalam and Mysore. It has been held that the great Vaishnavite Scholar Sri Vedanta Desika passed through Satyamangalam at a time, when, Sri Rangam was seeing its bad days under Malik Kafur. The Central Vaishnavite Temple, built in the Hoysala Style, beats hollow a perfect Vaishnavite temple in the number of granite and bronze images of Gods and Alwars, set up in it. Hence, we are not far wrong if we conclude that it ought to have been once a Vaishnavite centre. Similarly, Jain Temples seem to have abounded at the vicinity of the locality. Vijayamangalam, in the Erode to Podanur Railway line, boasts of a Jain temple, with rich endowments and in fact all Jain importations into the District should have passed through Satyamangalam (the land of Vishnu's Satya or prosperity). The very History of Kongunadu, (Kongu Mandala Satakam) was written by a Jain and we know that the contribution of the Jains to the Tamil literature is immense. During a talk with Mr. Suri Iyer, the only surviving Jain at Vijayamangalam, I became aware that the book was written by his great grand-father.

From the Naik, the place passed on to the hands of the Mysore generals in 1657. But in the frequent wars with Hyder and Tippu, the sway over Satyamangalam was changing hands often. In 1790, Colonel Floyd occupied it and Danaikencotta, a place about 10 miles to the south-west of it, after a hard-contested battle. Under Lord Wellesly, it passed into the hands of the British and from the 19th Century it continues to be under their control. It is a mountainous area, with a population educationally backward, though recently in 1932, the Coimbatore District Board has started a High School there. For attractive sylvan scenery, Satyamangalam affords the greatest scope.

The Sunkesula Project

KURNOOL DISTRICT

By

SRI K. NEELAKANTA RAO, B.A. B.ED.

Description of the Place.

Sunkesula, a small village in Kurnool Taluk of Kurnool District, lies 18 miles N-W of Kurnool town. It is a small and tiny village with no special economic or historical importance and the project alone has made its name noteworthy. The area near and around Sunkesula is saline, so that the salt from the earth is manufactured locally in salt beds for home consumption.

The site on which the Anicut is constructed is rocky. The Tungabhadra, on which the anicut stands, is the southern boundary of the Nizam's dominions and its width is about 4,000 feet from north to south, as the crow flies.

Importance of the Project.

The people of Kurnool particularly, are very proud of this Project, though it is small, because they eat the rice produced under it and drink the sweet water supplied by it, nay they breathe its cool, fresh, morning and evening air while strolling on its bund.

Rainfall.

In tropical countries, such as ours, not less than 40" of rainfall is necessary for the germination of seed and successful crops, as much of the moisture is taken away in the shape of evaporation. But, to its great misfortune the Kurnool district lies in the rain-shadow area of the Western Ghats where the monsoon is very uncertain. Bellary District gets an annual rainfall of 17" and Kurnool district 26". These districts are neither the recipients of the South-West Monsoons, nor of the North-East and therefore the rainfall is extremely low.

Irrigation in other Parts of the Presidency.

Under these unhappy conditions, irrigation alone, to some extent, can effectively remove the chronic poverty of these districts.

Whereas the Tamilnad has 40½ lakhs of acres under irrigation and the Andhras have 26 lakhs, we, the poor and helpless Rayala-seemites, have irrigation for 6 lakhs of acres.

But the enterprising spirit of an English Irrigation Company came to our aid under the name of "The Madras Irrigation and Canal Company, Ltd." This company was founded in 1858 just a year after the Great Sepoy Mutiny. This project formed a small part of an enormous scheme to irrigate nearly all the drier parts of Madras, but our project was the only one finished and it cost five times as much as was originally expected.

Origin and short History of the Project.

The canal called the Kurnool-Cuddapah Canal was constructed by a private Irrigation Company. The Company was authorized by an Act of Parliament to raise a capital of one million pounds. Five per cent interest on outlay was guaranteed by the Secretary of State who reserved to himself the right to control the proceedings of the company. But he had to purchase the works after 25 years.

The whole scheme was sponsored and executed by Sir Arthur Cotton. He took up the Sunkesula-Cuddapah section in the year 1863. The site of the Anicut was originally fixed at Kurnool but after work had progressed to some extent, it was found that the site was unsuitable and it had therefore to be abandoned. About 1·1 lakh of rupees was the loss due to this change. It was then moved to its present site and was finally built there. The advantage of the Sunkesula site was the existence of a good rocky foundation, which facilitated the construction of the anicut. The Project was completed by 1870, seven years after its start; but the construction was characterised by lack of proper supervision and by wasteful methods. The anicut breached on a number of occasions (in 1864, 1868 and 1882) and large sums were spent on repairs.

Comparative Study.

The Government took over the project on the 1st of July 1882, on a payment of 3·02 crores. Under this scheme about 72 thousand acres are irrigated. Comparatively, this is a very costly project as will be shown below.

Project	Cost	Area irrigated		Rate per crore Rs.
1. Sukkur	20 crores.	75	lakhs of acres.	3 3/4 lakhs per crore
2. Mettur	5 ,,,	3	,,	60 thousand acres per crore
3. Kannambadi	2 1/2 ,,,	2	,,	80 ,,, ,,,
4. Proposed Tunga-bhadra project	11 ,,,	11	,,	1 lakh per crore
5. Sunkesula	3 ,,,	72 thousand acres	24 thousand acres	per crore.

Thus we see, that of all the projects mentioned here, the Sunkesula project is the most costly, though there is no hydro-electric scheme attached to it. Likewise the proposed Tungabhadra project is likely to exceed its modest estimate of 11 crores.

Measurements.

The Anicut is in two sections with an island in the middle connected by a flood bank 4 furlongs and 28 feet in length. The northern portion of the anicut is 1,064 feet long and the southern 3,294 feet 5 inches. To avoid breaches, in 1886, the crest of the anicut was lowered by 3 feet.

Talukṣ Irrigated.

The Kurnool-Cuddapah Canal takes off from the Tungabhadra at Sunkesula, and runs through Kurnool, Nandikotkur, Nandyal, Sirvel and Koilkuntla taluks of Kurnool District and through Jammalamadugu, Proddutur and Cuddapah, taluks of Cuddapah District.

Economic Value.

The Canal is 191 miles long and was originally intended to be a combined irrigation and navigation canal. Only the first 75 miles of the canal carry some traffic, the chief articles transported being firewood and stone slabs. Navigation below 75th mile was abandoned as unprofitable.

Partial Failure of the Scheme.

From the beginning the canal did not fulfil expectations. The water in the canal was not fully utilized as it passed through a tract

which combined the disadvantages of black cotton soil and sparse population. The Madras Deccan especially the Central Districts of Kurnool, Cuddapah, Anantapur and Bellary suffer from want of man power. Whereas the Bengal Presidency has a population of 611 per sq. mile, the Deccan plateau has but 168 persons. So it is possible for Bengal to raise rice which requires much human labour, but the Central Districts may not be able to furnish the labour required for wet cultivation under the Tungabhadra project. But this does not mean that we do not want the Tungabhadra project. We do want it not only for irrigation but for generating hydro-electricity which may be supplied at a lower rate than at present.

The other causes for the partial failure of the Sunkesula scheme are (1) Dry holdings are large. (2) Ryots get as much income as they desire from dry crops such as cholam, korra, cotton and ground-nut. (3) Lands give better return with dry crops than with wet; the labour required for dry crops is also less. (4) Ryots are lazy, conservative, easily contented and will not apply labour to bring lands under wet cultivation. (5) Even in a bad year, water is only taken at the last moment. (6) There is optional irrigation; the ryot may irrigate his land or may not. Thus wet cultivation has not made much headway and has been at the same level as it was during the past 30 years.

Extent of Irrigation.

The Canal irrigated 72,624 acres in 1935-36. The crops chiefly grown were paddy, turmeric, cotton, ground-nut and tobacco. This year there was a loss to Government. The remedy suggested was to convert the lands from dry to wet and make the levy compulsory both for dry and wet crops. But to enforce this levy, legislation is necessary.

The ayacut (land irrigable, wet and dry) of the canal is 103,014 acres. Of this, Kurnool District has 53,935 acres and Cuddapah District has 49,079 acres.

Irrigation Season and Practice.

The canal is opened on the 15th of June and actually irrigation begins from the 15th July. It also feeds several tanks; the most important of which lies at Nandyal in Nandyal taluk, Kurnool District.

The garden crops generally raised are plantains and betel leaves in Kurnool and turmeric in Cuddapah; sugar cane is largely grown under the Nandyal tank. The dry crops raised are drilled paddy,

cholam, chillies, garlic, onions, cotton, ground-nut, ragi, korra, coriander, gingelly and horse gram.

Sections and Water Supply

Of the 191 miles of length of the canal, the first 94 lie in the Kurnool taluk; the next 42 miles lie in the Nandyal taluk; and the rest in Cuddapah District. The canal supplies drinking water to Kurnool town with a population of 40 thousand and to Nandyal with a population of 23 thousand.

Maintenance and Repairs.

The limit for the annual repairs to the canal has been fixed at Rs. 70,000. The amount includes repairs to minor distributaries, wages for work, establishment, tarring, oiling shutters, silt clearance and gravelling.

Conclusion.

In conclusion, it has to be admitted that though the Sunkesula project did not fulfil all its expectations, it has done much to remove unemployment and poverty in the Kurnool district.

Extracts from Periodicals

THE PROJECTION OF INDIA

A NEW APPROACH TO NATIONAL UNITY.

By

M. RUTHNASWAMY, C.I.E.

One—if it is not the only—reason for the dismal deadlock into which all discussion about the future political progress of India has been thrown is the fact that India has not been given the first place in that discussion. The name of India has, no doubt, been taken in such discussion. But when one comes to probe the argument, one finds that by India is meant not India but some favourite *eliche* of the writer or speaker or party that has taken part in the debate. One party means by India, Hindu culture, Hindu Dharma, Hindudom ; a second party when it speaks in the name of freedom and progress of India has in its mind Islamic culture and civilisation. A third party stands for India when all that it stands for is its own political and social ideology. The net result of this discussion on the future of India has been the confusion of tongues and the clash of battle. Of the two factors that go to the making of a State, Land and People, the second, the People, has been given undue prominence and weight in current political argument in India. Muslims are arrayed against Hindus, and the interests, the influence, the rights and liberties of either people become the bone of contention. Electorates are required not for particular localities, but for particular communities. Even nationalism speaks only for the people of India. This preoccupation does not prevail in the political field alone—it has entered the domain of culture. At Waltair is founded not the University of Waltair but the Andhra University, at Benares the Hindu University and at Aligarh the Muslim University.

The Land of India

The preoccupation with this political factor, the People, having led us into such distress and disturbance, we might consider whether the way out might not be to turn our eyes and our hearts to that other factor in the making of India, the Land of India. The

ethnography of India having failed to give us unity and solidarity, one might turn to the geography of India. The Land of India has its own rights and liberties, its own interest and importance. And these have not been given due consideration in recent schemes for the future of India. The unity of India is determined by its definite frontiers, the Himalayas in the north, the Hindukush in the north-west, the seas on the east and the west. No such decisive walls, whether of land or water, divide India up within itself in fragments of independent or self-sufficient States. If India has been divided up in all its history till the other day it is because none of its peoples was able to acquire the political strength to realise its unity. But all the time the Land of India was calling its people to achieve that unity. The long line of its land frontier and the still longer line of its sea frontier require that India shall have the strongest army and navy possible, whatever the traditions of her peoples or their philosophy or their religion may say. The Land of India, worked to exhaustion for centuries, requires rest and the widespread establishment of small or large scale industries and the development of town life away from the village-culture to which some would call her back. Arguments like these the Land of India addresses to her leaders and peoples. It is high time they listened to the voice of the Land of India. It might achieve more for the unity and freedom and progress of the country than what the People of India has. Anyway, it is time we gave it a chance.

What We Require Now

A few years ago, Sir Stephen Tallents, the able Permanent Under-Secretary to the Post Master General, published a brochure entitled *The Projection of England*. "The burden of his argument was that England was not known enough within the empire or in the world, and that it was up to her to make herself better known if she was to survive in the modern competitive world. He called upon England to make use of all modern scientific media to advertise herself to the world. To-day, he says, as the result of scientific discovery, a people is known to its fellows by the impression which it makes upon them through the cable and the printing press, on the air and upon the screen. He advises England that if a nation would be truly known and understood in the world, it must set itself actively to master and employ the new, difficult and swiftly developing modes which science has provided for the projection of national personality." The projection of India is what the people of India require, in order to make them jealous of her

unity, her freedom, her progress. They must know India if they are to live and work and fight for India. What do they know of India now? It is true India is heard on everyone's lips, splashed on every page of the daily newspaper, blazoned forth on every kind of platform. But what do they mean by India? More often than not, the Hindu means by India Hindu Dharma, the Muslim Islamic culture, and the Nationalist or Congressman his party *credo*. What does the average villager know of India except his own village or at the most his own district? Does a villager in Tirunelveli know anything of the hills of the Frontier, or the vale of Kashmir, or the rivers of the Punjab? There are thousands, probably millions, that have not seen the sea and known what it means to the life and liberty of India. The figure of India, its form, its beauty, its hills and its rivers, its flora and its fauna must be made known to the people of India. "If we are to love our country, we must make it lovely," said Burke. But India is already lovely and its loveliness must be made known to her people if they are to love it and do all for it, that love calls forth. India requires to be projected to her people. What India needs now is the exercise of the art of national projection.

A New and Complicated Art

It is a new and complicated art, as Sir Stephen Tallents proves it to be. It demands "an intense study and a continuing apprenticeship"—for it has to present the numerous and complex features of a large and varied country to a numerous and multi-graded community. It has to be a corporate act and therefore requires "concentrated planning and organisation." The modern media of communication of thought and pictures of things to man, the Press, the Cinema, the Radio, have to be studied as a means of publicity and in the reactions of men as individuals and groups to them. This art is to organise the presentation of the facts of India's life—its natural features, its economic and social life, its industrial awakening—in a way that will get them across to people's minds and hearts. The methods of successful salesmanship and publicity have to be studied. The new means of communication—the screen and the air—have to be used on a large scale. The cinema can teach not only the literate but the illiterate, not only the classes but the masses. Two or three small schools of Russian producers, we are told, working at no great cost and producing a mere handful of films, have done more than all the studies of the world to show us what an incomparable instrument of national expression the cinema might be. We want producers in India to let

India reveal herself to her sons and daughters. What a great service to the making of Indian unity can be rendered by documentary films about the geography, the history and the life of India. Radio programmes all over the country must provide for talks, and songs and plays depicting the features of Indian scenery and the still and moving life of India. Tourist and Travel agencies must organise tours of the common folk to all parts of the country. The youth of the country must learn to love India long before they become conscious of their separate communities.

A Corporate Society of National Projection.

All this work would require the formation of a school or society of National Projection. It would be composed of representatives of all the arts that have to do with national projection—of the Press, of the cinema producers, of the All-India Radio as well as of the people. It might be organised on the lines of the British Broadcasting Corporation. Its funds must be drawn from contributions by all Governments in India—for they must be interested in this national projection which will counteract the evils of excessive communalism—and from all those that are interested in extending and developing the idea and the practice of the love of India. This Society of National Projection would not only plan and organise the revelation of India to her people through the Press, the Cinema and the Radio. It would organise a National Exhibition every year or periodically to publish not only the industrial but the artistic, literary, and cultural achievements of India and facilitate tours to this Exhibition from all over the country.

Not merely "India First" but "India" as the only object of the secular study, devotion and loyalty of the people of India is the slogan of national projection. Politics divides us, Religion divides us, Culture divides us. But the land and the love of the land of India may unite us. No political, or communal, or religious or cultural differences can affect our love of the snow tops of the Himalayas, or the rugged hills of the frontiers, or of the valley of Kashmir, or of the great rivers of India, or of the Downs of the Deccan, or the limpid blue of its seas. It may be that while Politics and Culture and Religion divide us, the land of India and the knowledge and love of that land may unite us and the land of India has greatness, and beauty, and appeal enough to achieve even that difficult end.

THE BURMA ROAD**A WONDER OF THE WORLD**

Some highly interesting information has been made public concerning one of the greatest civil engineering achievements of modern times, carried out on communal lines by the people of the Republic of China, that is the Burma Road.

This extends from the Burma frontier of China right into the centre of the latter country to the present war time capital of Chungking, a distance of nearly 700 miles. Also the work has been undertaken by an army of over 160,000 peasants, not only men and women, but also children, with supervision by only about 200 engineers, many of whom incidentally have been British and American volunteers, anxious to lend a hand in this gigantic national achievement.

This road crosses some of the most difficult country, including high mountain ranges, and over 300 bridges and more than 6,000 culverts have had to be constructed, whilst the carrying capacity, including the weight of the vehicle, is 5-10 tons, and hundreds of 2-ton motor lorries are operating upon it. By this means material of all kinds can be imported from India and Burma, particularly through Rangoon, and the construction was commenced at the end of 1937 as a result of the wisdom and imagination of the Government of the Chinese Republic, who foresaw that the Japanese naval blockade would cut them off eventually from supplies of munitions, particularly from the United States, and to some extent from Soviet Russia.

The first half of the road from Auting on the Chinese-Burma border to Schaknoan in China, a distance of 350 miles follows what is known as the Old Tribute road, which is essentially a caravan and mule track whose age goes back to the dawn of history. For example it was this track that was followed in the Middle Ages by the famous Venetian traveller, Marco Polo, who in the most extraordinary manner, it may be remembered, travelled over the greater part of the vast Japanese Empire when most of Europe was in complete ignorance that such an Empire even existed. This track, however, had to be completely realigned, re-bridged and rebuilt, and has been constructed of packed stone with rolled gravel or broken stone, with a total width of from 18-24 feet, and an actual travelling surface of at least 10 feet. Needless to state it was almost impossible to get any modern equipment in the way of steam rollers,

make a cup of tea when travelling. The ice had to be collected, then thawed and finally boiled. He added that he used Primus stove, for this purpose and that in cold weather it often took as long as threequarters of an hour to make enough tea for three people.

Mr. Bentham told our Representative that the other phenomena characteristic of the Arctic included "Sun dogs" and the "Northern lights." The "Sun dogs" he explained, consisted of false suns, seen only in cold weather, appearing above, below and on either side of the real sun. Usually not more than four sun dogs could be seen at a time; but under favourable conditions as many as eight had been observed. "Northern lights" were seen in the nights during the winter. They took often the form similar to a search-light beam. When they were shining well, they appeared like a gigantic fire works display of variegated lights shimmering across the whole sky.

News and Notes

Ourselves.—The Journal of the Madras Geographical Association has completed its 15th volume with the last issue for 1940; and it now emerges under the new title of “*The Indian Geographical Journal*,” in response to calls and suggestions from several friends in Northern and Western India. The change is not a mere nominal one, but involves great responsibility; and it has not been lightly undertaken without deep consideration and fore-thought. With the experience we have gathered these 15 years and with the co-operation and goodwill of competent geographers in India who have so kindly and willingly offered their help and support, we hope to run it successfully as an All-India Journal.

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There would have been no need for this change if the proposed *Indian Geographical Federation* had come into being with its own organ. In accordance with the suggestion made by the British Geographers at the Calcutta Session of the Indian Science Congress in January 1938, a Committee was appointed to urge Provinces and States where Geographical Associations or Societies did not exist, to start them, and to bring them together into a federation for several purposes among which the running of an All-India Geographical Journal as its organ was prominently mentioned. But despite earnest and strenuous attempts for more than three years, it was not possible to get new associations started in several States and Provinces for the simple reason that Geographical studies had no proper place in their Universities and Colleges, and very few persons were consequently interested in the subject. Nor was there any enthusiasm or desire among the few existing Associations to come together. Under these circumstances the call came to us as the oldest Geographical Association in India with the longest journalistic record of achievement; and we have responded with the fullest hope of getting support and encouragement from all in our endeavours to serve the cause of Geography in this country.

* * * * *

Our aim and policy shall not be merely provincial; and our appeal and service shall be to the several Universities and Colleges in the whole of India. We shall stand as hitherto for Geographical research as well as for dissemination of geographical knowledge, but in a far wider field.

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Geography in the Indian Science Congress.—Meantime, it is most distressing to learn that the Indian Science Congress has decided at its Benares Session in January last to amalgamate its short-lived Geography Section with the Geology Section—a decision which is tantamount to abolishing it—on a chance vote taken at a Meeting of the General Committee in an almost empty house on a cold winter night in the teeth of unanimous opposition of all the Geographers present.

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In this connection it may not be out of place to trace the history of this short-lived Section. For over two decades, the Indian Science Congress Association which is considered to be the premier scientific Association in India, had not thought of Geography at all as a subject worthy of any place in it—so low has been the position of Geographical studies in Indian Universities and Colleges. For the Indore Session of the Congress in 1936, the Section of Geology was nominally expanded to include Geography also, under the title of the Section of Geology and Geography, when there were 16 papers contributed on Geology and *none* on Geography. At the Hyderabad Session next year (1937), the Joint Session had 52 papers, of which only three were on Geography.

* * * * *

Then came the Silver Jubilee Session of the Congress at Calcutta in 1938, when window-dressing was required against the visit of the British Geographers ; and so, a Section of Geography was temporarily created for that year only. But even under such conditions, the Section had 21 papers contributed, which were all agreed generally to be good. Thanks to the action taken by the British Geographers, who, by means of a resolution in the Section, as well as by a separate memorandum, pleaded for its permanence, the Executive Committee of the Congress decided to retain it permanently. The wisdom of this action was proved by the fact that at the Lahore Session next year (1939), there were again 20 papers for the Geography Section as against 18 papers for the Geology Section at the same time.

* * * * *

Despite all this phenomenal progress, however, at the Madras Session in 1940, a Damocles' sword was hung over the Section in the shape of the proposal to re-amalgamate Geography with Geology ; and due to strong opposition, an amendment was carried to consider the question again next year, thus putting off the evil day. At Benares in January this year, the one existing body

in India that could bring all the Geographers together on a common platform was practically annihilated with a year's lease of life at Dacca.

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For the Dacca Session of the Congress Geography will accordingly have a separate section *for the last time*, after which it will be an annexure to Geology. We take this opportunity to congratulate Mr. George Kuriyan, Head of the Department of Geography in the University of Madras, who has been elected President of the Section, and Prof. Nafis Ahmed of Islamia College, Calcutta, who has been elected Recorder of the Section.

* * * * *

The aims and outlook of Geology and Geography are so variant that the votaries of the two subjects cannot be expected to work together usefully in an unequal and unwilling partnership. Nor do the Geologists seem to be happy over this consummation. It is, therefore, to be hoped that the question will be raised again and decided in favour of Geography, restoring it to its proper place with a separate Section of its own.

* * * * *

It is this gloomy prospect that drove some ardent Geographers to the length of discussing an annual Indian Geographical Conference, like the Economic, Philosophical, Oriental and other Conferences. But the proposal has not so far materialised, though it denotes the strength of the feelings of disappointment and resentment at the decision to close the Section.

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It is under these circumstances that a long cherished idea has been put into action,—that our Journal has been changed into an All-India one to provide a common organ and a liaison to all workers in the field of Geography in this vast country.

* * * * *

The War and Geography.—The unsatisfactory position and immature development of Geographical studies in most Indian Universities are largely responsible for the general absence of geographic outlook even in the educated Indian, for the improper appreciation here of the part played by Geography in this great world conflagration such as the underlying geographical causes that led to it or the geographical factors at work steering or shaping the course of it. And when the Peace Settlement is made, Geographical considerations will have to enter largely, if that settlement is to be abiding.

* * * * *

Our country has been lucky so far to escape the grave calamities that have befallen so many of the European countries ; but even in this country it is interesting to note the rapid reactions and adjustments to the War. The resources of the land are now better taken stock of, better worked up and better utilised ; un-exported materials like groundnuts are attempted to be used in new ways within the country itself ; and substitutes are being tried for dyes, drugs and other things that are in great demand but cannot be imported. Even heavy industries are coming in, rather slowly though.

* * * * *

And amid the war-time clash of internal politics, comes a new suggestion from Prof. M. Ruthnaswamy, C.I.E., as a solvent of the communal, religious, linguistic and other differences, to approach the problem from the Geographical or *Land* point of view rather than from the point of view of the *Peoples*, as all such attempts have unfortunately proved so far abortive on account of the multifarious differences that have loomed so large. This contribution entitled "*The Projection of India*," extracted elsewhere in this issue will be found to be highly interesting and thought-provoking.

* * * * *

Bihar's 'Problematic Rivers'.—A study of Bihar's 'problematic' rivers for their control is expected to form an important part of the activities of the Public Works Department, Bihar, during the year.

The Kosi river which has been flooding an area of about a hundred square miles every monsoon, comes first on the list of the rivers to be studied. An enquiry on behalf of the Nepal and Bihar Governments is shortly to be started to investigate the possibilities of training this river which is now threatening Darbhanga district, one of the most densely populated areas in the province.

Gauge and velocity readings are also being taken at Dehri-on-Sone to find out tendencies of sand deposits which have necessitated the remodelling of the headworks of the Sone canals at Dehri-on-Sone.

Estimates are being prepared for repairs to 115 miles of embankments on the left bank of the Gandak. These embankments protect from floods 4,000 square miles of fertile and thickly populated land. The cost of maintenance and repairs has been about Rs. 35,000 annually in the previous years.

* * * * *

Mettur Hydro-Electric Scheme.—The scheme utilizes a part of the water let down for irrigation purposes from Mettur reservoir. The dam is 176 ft. high, and impounds a total of 93,500,000,000 cubic feet of water. The peak load at the powerhouse has already risen to about 11,000 kilowatts and is expected to reach 17,000 kilowatts by the end of 1940-41, when the several extensions now under construction begin operation. At Erode the Mettur System is linked with the Pykara net-work and both can work in parallel as and when operating conditions demand. The Scheme supplies power to the districts of Salem, Trichinopoly, Tanjore, South Arcot, North Arcot, Chittoor and Chingleput.

* * * * *

Papanasam Falls to be harnessed.—Madras will have a third hydro-electric undertaking in operation by 1942. The scheme is to utilize the fall of about 330 feet in the passage of the Tambraparni river, in the Tinnevelly District. By the construction of a masonry dam 176 feet high across the river in the foothills of the Western Ghats above Papanasam, a reservoir of 5,500,000,000 cubic feet capacity is being created. When the scheme is in full operation, a peak power of 28,000 kilowatts is expected to be generated. The scheme covers Tuticorin, Koilpatti, Madura, Tenkasi and Rajapalayam, and will incorporate the existing lines in the area and the system will be linked to Pykara at Madura. Construction is now in progress.

* * * * *

Geography at the Calcutta University.—A degree examination in Geography will be held for the first time by the University of Calcutta this year, at which about 50 students, including four women will appear. The course was started in the University two years ago, and it is now proposed to introduce the subject in the post-graduate department.

A Geographical Exhibition was organised at the Darbhanga Hall of the Calcutta University by the Calcutta Geographical Society; and exhibits were sent to it from the Geological Survey of India the Meteorological Survey of India, the Imperial Library and the Geographical Department of the University.

A Map of India during the time of the Emperor Jehangir, drawn by a European draftsman and an old Persian Map of the Grand Trunk Road with a sketch of that part of Calcutta which was inhabited by the English in 1756 were among the large number of exhibits displayed.

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The 17th All-India Educational Conference will be held at Srinagar (Kashmir) from the September 27-30 during the Dusserah holidays.

* * * * *

The Madras Geographical Association.—*The 11th Provincial Geographical Conference, Madras*, will be held at the Rishi Valley, Chittoor District on the 15th, 16th and 17th May, 1941—under the Presidency of Mr. M. Subramania Ayyar, when papers on various aspects of the Geography of the District will be read and discussed.

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A Summer School of Geography will be conducted by the Association at the Geography Department of the Teachers' College, Saidapet, from 7th April to 6th May 1941 for the benefit of teachers of Geography in secondary schools.

* * * * *

Four meetings of the Association were held during the current quarter as follows:—

25—1—41 : Mr. N. Subrahmanyam gave a talk to teachers on “*Geographical Excursions in and around Madras*.”

11—2—41 : Mr. Robert Bentham, Geologist of the Oxford University Ellesmere Land Expedition, gave a lecture on “*The Northern Hunters*.”

15—2—41 : Mr. George Kuriyan read a paper on “*Growth of the Population of Madras*.”

8—3—41 : Mr. N. Subrahmanyam read a paper on “*Regional Distribution and Relative Growth of the Cities of Tamil Nad*.”

Select Contents

The Geographical Journal : October 1940.

Harnessing the Columbia River : The Grand Coulee Dam and its Geographical Setting—By G. B. Barbour.

The Geographical Journal : November 1940.

Desert versus Forest in Eastern Africa—By E. J. Wayland.

The Scottish Geographical Magazine : November 1940.

Ancient Greece and the Healing Art—By Douglas Guthrie.

The Changed Baltic—By J. F. Stewart.

Geography : December 1940.

Bulgaria : A Summary—By S. H. Beaver.

The Burma Road—By P. M. Roxby.

Transhumance in Europe—By E. Estyn Evans.

Mental Factors in Geographical work—By C. L. Heywood.

The Geographical Review : January 1941.

The Nitrate District of Tarapaca, Chile : An Aerial Traverse—By John L. Rich.

The Eastern Outposts of the Magyar—By John B. Appleton.

Chinese Place-Names and the Appreciation of Geographic Realities—By J. E. Spencer.

Climatic Regions of Corea and their Economy—By Shannon McCune.

The Koppen Classification of Climates in North America—By Edward A. Ackerman.

Settlements of the North-Eastern Canadian Arctic—By John Q. Adams.

The Indian Journal of Political Science : January—March 1941.

China's War of Resistance and Japan's Dilemma—By S. Lautenschlager.

India and the Changing Politics of Asia—By Prof. S. V. Puntambekar.

The Karnataka Historical Review : Vol. V—Part II.

Town-Planning in the Vijayanagar Empire. By R. N. Saletore.

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Economic Resources of Madras Presidency : Groundnuts.

Mathematical Gazette : July 1940.

Correlation of the Teaching of Mathematics and Geography—By J. Fairgrieve.

Reviews

The Complete Geography Series : Asia and Australasia. By Alys Mamour. (Macmillan & Co., Ltd.). Price 4sh.

The book under review is the third of a series of four volumes, designed to provide a complete course in Geography for pupils aged eleven plus. Each of the volumes forms a self-contained complete course, so that they can be used independently also.

The series comprise the World as the Introductory book and three "gores" of the world in order—the Americas, Asia and Australasia, and Europe and Africa. The keynote of the volumes may be summed up in the words Reliability and Readability ; but special mention should be made of two of the noteworthy features, namely, the exercises at the end of each chapter and the many short excerpts from travel books and authoritative volumes arranged and inter-woven as part of the text, the list of them being given at the end. In fact, the latter feature is unique and characteristic of the volumes serving to sustain interest, enabling pupils easily to follow and appreciate the facts presented. Other important points in the series are the specially prepared maps, the numerous valuable illustrations from reliable sources, suggestions on geography games, handwork, local study, essays and debates. The treatment of the several countries and regions is balanced and in proper perspective. Naturally Asia occupies three-fourths of the book and Australia the remaining fourth.

A Map Book of Africa and South America : For Juniors and Middle Forms. By A. Ferriday. (Macmillan & Co., Ltd.). Price 1sh. 9d. paper ; 2sh limp cloth.

The teaching of Geography has ceased to be the dull bookish thing that it was ; and among the factors that contributed to it has been the use of books like the one under review.

This map book of Africa and South America follows the plan of the previous books of the series, reviewed in earlier numbers of the Journal, namely, that of presenting the main geographical features in map form with accompanying text on the opposite page. Being intended for junior and middle forms, the treatment is somewhat simpler and less detailed than in the map books of North America, Asia, Europe and British Isles. Hence, unlike in the

latter books, only one question or exercise is set at the foot of each page of the text because of the shorter time available in the Junior school. On the last page a good number of comparative questions on the two continents are appended.

Philip's Fundamental School Atlas. Edited by George Philip and George Goodall. (George Philip & Son, Ltd., London). Price 3sh. 6d.

This Atlas treats comprehensively the main aspects of Geography :—Relief, by means of form-lines and a layer system of colouring; Climate, including Temperature, Seasonal and Annual Rainfall, Pressure and Winds, all summarised in maps of the Climatic Regions of the World and the Continents, and supplemented by Climatic Graphs of stations chosen to typify each region; Vegetation, showing distribution in its natural form; Human Geography, as reflected in the distribution of Population, Races, Languages and the various Nations of the World; and Economic Geography, showing the broad activities of both civilised and primitive Man in Industry, Agriculture, Pastoral Farming and Forestry, and those regions where Nature makes no response to human endeavour.

Clarity of presentation has been secured by omitting all inessential matter and including only salient facts. Each map deals only with a single subject; and simplicity has been the keynote of all the maps, which include only essential ones, shown in clear and legible type. Economic diagrams and a carefully prepared index are other good features of this useful School Atlas.

Books and Journals Received

Asia and Australasia : By Alys Mamour.

A Map Book of Africa and South America : By A. Ferriday.

Philip's Fundamental School Atlas : Edited by George Philip & George Goodall.

Report of the Department of Industries and Commerce, Madras, for the year ending 31st March 1940.

The German Colonization of Anaheim, California : By Hallock F. Raup.

Land Forms of San Gorgonio Pass, Southern California : By Richard Joel Russell.

Toward a Theory of the Morphologic Significance of Turbulence in the Flow of Water in Streams : By John B. Leighly.

Marquesan Meteorology : By John B. Leighly.

Graphic Studies in Climatology : III. A Graphic Interpolation Device for dating the Extremes of the Annual Temperature Cycle : By John B. Leighly.

The Dominican Mission Frontier of Lower California : By Peveril Meigs.

The Extremes of the Annual Temperature March with particular reference to California : By John Leighly.

The Towns of Medieval Livonia : By John Leighly.

San Bernardino, California : Settlement and Growth of a Pass-Site City : By H. F. Raup.

The Scottish Geographical Magazine : November 1940.

Indian Information : From December 15 to March 1, 1941.

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Visvabharathi Quarterly : November 1940–January 1941.

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Karnatic Historical Review : Vol. V, Part II (July 1938), 1940.

The Indian Journal of Political Science : January–March 1941.

Indian Co-operative Review : July-September 1940.

Nagaraprabharini Patrika : Vol. XLV-No. 2.

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Geography : December 1940.

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Problemi Fizicheskoi Geografii : Nos. VIII and IX, 1940.

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MIDDLE SCHOOL GEOGRAPHIES

Middle School Geographies : By C. Ragunathan,

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THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

Vol. XVI

April—June, 1941

No. 2

Environment and the Distribution of Population in India

By

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Department of Geography, Muslim University, Aligarh.

Human groups, like plant associations are subject to the influence of environment. The object of this discussion is to study how this influence manifests itself in the distribution of population in India.

One of the most suggestive relationships between man and his abode—the earth is that between any given area and the number of its inhabitants, commonly known as the density of population. If detailed statistics of population are compared with our large scale topographical maps¹ it is possible to find out by analyses, some connection between human groups and environmental conditions. These maps offer numerous suggestions as to the causes of settlements and the types of their distribution and have been very helpful in arriving at so many conclusions.

Mean Density.—The mean density of the entire earth is 34.18 persons per sq. mile,² that of India as a whole 195 persons.³ Considering the enormous area involved in its computation it is a very high figure. Europe has a mean density of 127, America 41, China 80.5. This density of 195 is a very variable factor appearing

1. 1" to a mile or 1" to 2 miles. Even those of 1" to 4 miles are quite suggestive in some respects.

2. According to the estimate of the International Statistical Institute.

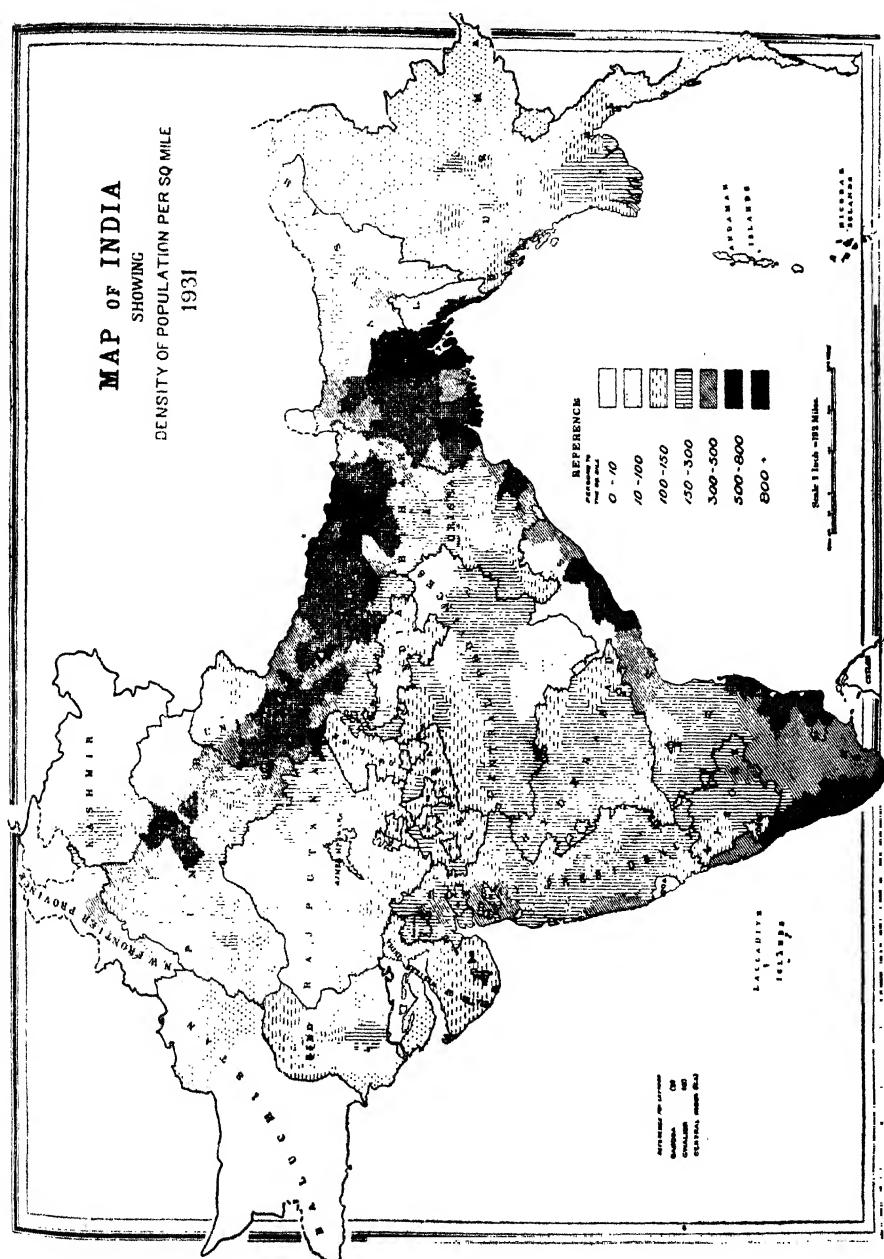
3. All the figures relating to India are based on the Census of 1931, unless otherwise mentioned.

at the lowest as 6.5 persons per sq. mile in the mean density of Baluchistan, the Chagai district of which has only one person to the sq. mile, and at its highest in the most thickly populated parts of the south-west Coast, the general density of Cochin State including both the thickly populated coast lands and the almost uninhabited highlands being 814.2 persons per sq. mile, and reaching in one village the amazing maximum found in any purely rural population of 4000 persons to the sq. mile. In Bengal there is even a higher general level of density, since the Dacca division has a mean density of 935 persons and reaches a rural density of 3,228 for Lohaganj thana.

Growth of population.—The density of the population of India is high and has shown progressive increase. According to Moreland the population of India, at the time of the death of Akbar (1605) was roughly 100 millions. In 1750 it was estimated by Shirras at 130 millions, in 1850 estimated by Mukerjee as 150 millions; in 1881, the year of first general Census 254 millions. It has since then risen to 353 millions in 1931 and to approximately 377 millions in 1935 and 400 millions in 1940.

Its Causes: (1) *Historical.*—This consistent and continuous growth of the total population of India and its present high average density may be attributed principally to three causes, (1) Historical; (2) Socio-religious; and (3) Climatic. India was one of the earliest countries to be peopled and contains traces of Palaeolithic cultures in the Mountains of Central India and Orissa and of Neolithic and later civilizations in the Valleys of the Indus and the Ganges. Besides, throughout prehistoric and historic times, its population has been repeatedly replenished and deluged with the incursions of migratory hordes from Central and Western Asia—migrations from the desiccated lands to those of plentiful monsoon rains. These people have been attracted further and further towards the eastern Gangetic Plain by the charms of more luxuriant vegetation and more pronounced and regular rainfall.

(2) *Socio-religious.*—Universality of marriage is another cause of the high average density of India. Here economic necessity has been transmuted into religious precepts. In the Brahmin doctrine marriage and procreation of numerous progeny are a sacred duty which assures ancestors of the performance of domestic rites and rituals. With a very low standard of living, for an agriculturist to possess many children is an asset rather than a liability. They help him in his work on the field and save the money for extra



labour. Multiplicity of children is thus considered a sign of good luck.

(3) *Climatic*.—The climate over a large part of India is warm enough to have a year round growing season. Many plants quickly complete their cycle of growth and take advantage of the intervals between seasonal rainfall. Thus a comparatively large population could be supported in any such area. Regulation of water-supply for the systematic tillage of crops, succeeding one another at brief intervals, has further helped the inhabitants to concentrate and to form large groups.

Environment and density.—In any country, environment has an important bearing on the density and distribution of population; but its effect varies in extent and magnitude in different countries, where different factors come into prominence. The predominant density factors in India are by no means those which count for most in western countries, where the variations in population depend mainly upon the progress made in commercial and industrial development. More than two-thirds of the population of India is directly dependent on agriculture and so here the density of population is mainly determined by the causes which are responsible for variations in the productiveness of the land. So it will be found that the most important factor governing the density and distribution of population in India is adequacy of water supply, natural or artificial. It will also be seen that where the environment changes from less productive to more productive, there is also found a relatively larger density of population.

The influence of an environment, using the term in the wider sense, may be better studied separately in its two principal components physical and cultural. The former includes the conditions that have been provided for man by nature for his habitat—configuration of the surface, climate, soils, hydrography and natural vegetation, while the latter constitutes the facilities that he has created for himself by the application of his skill and the exploitation of natural resources—cultivation of suitable crops, irrigation and the development of communications and industries.

PHYSICAL ENVIRONMENT.

Configuration.—Configuration of the land is an important factor in the distribution of population, as cultivation is very precarious in a rocky and mountainous country and becomes increasingly so towards the tops of the hills and mountains.

Water drains off immediately after the rains. On high ground even a short break of rains is injurious to the crops and a long one destroys them. Moreover, when land on a hill slope is broken up for cultivation it soon becomes subject to erosion and its soil is easily washed away, and long intervals of fallow are required to recover fertility. The elaborate system of terrace cultivation is possible only when the hill-sides are not steep. So we find that the whole fringe of the mountain area bordering the Indo-Gangetic Plain as well as the Deccan Plateau is so thinly populated. The southern slopes of the eastern Himalayas in Assam and Bengal with a higher amount of rainfall are comparatively more populated. The habitability of the mountain area decreases as it becomes more and more unapproachable. Northern Kashmir⁴ has much lower density than the southern. The habitability also decreases with altitude. On account of the rarefaction of the atmosphere most people find difficulty in breathing at altitudes of 10,000 ft. or more.⁵ The people are irregularly distributed really along approachable main Valleys⁶ or intermont Plains⁷ where agricultural possibilities are greater and means of communication better.

Permanent occupation reaches a higher altitude in Western Himalayas than in the Eastern as the climate is drier and the cold more bearable.

Where considerable stretches of flat land occur on the southern slopes of the Himalayas, with adequate water supply and are easily approachable from the plains a number of hill-stations—Darjeeling, Mussoorie, Nainital and Simla have grown up which maintain a floating population, migrating thither from the plains below, in summer.

The plains are evidently the most desirable areas for human habitation and progress. Throughout India the most thickly populated tracts are the level plains where natural water-supply is adequate and large portions of land are fit for tillage—Eastern Bengal, Bihar and the adjacent parts of United Provinces. The density over the whole of this area is over 600 persons to the sq. mile. The next most densely populated tracts are the low-lying plains

4. See Sheet No. 43N. or 43G/13. (India and Adjacent Countries Series).

5. See Sheet No. 43 F/13.

6. See Sheet No. 43 P/13. or 43 G/14.

7. See Sheet No. 43 P/15.

along the sea, in the southern part of the Peninsula with a density between 450 and 600. In Western U.P. and Eastern Punjab though configuration of the surface is as favourable as in the east, yet the rainfall is scantier, and therefore the density is not so high. In point of density these tracts fall in the same group with the coastal plains.

Within the plains the density of population varies, amongst other factors, not only with the relation of the cultivable area to the gross area of any district but also (1) with the percentage of the cultivated to the cultivable area, (2) the percentage of the double-cropped area to the total cultivated area and (3) the nature of the crops grown. All these factors depend to a very large extent, on water-supply. Mukerjee has estimated⁸ that the total percentages of the cultivated to the cultivable area have now reached the phenomenal figure of 75 to 95 per cent. in the Ganges Valley. This partly explains its higher density when compared with the Indus Valley. The Provinces of Bengal, Bihar and Madras have the highest acreages of '*the area sown more than once*,' Bihar leading.

The Deccan Plateau represents conditions intermediate between the northern mountains and the Indo-Gangetic Plain, not only in relief but also in the distribution of population. The density is generally moderate. In parts of Orissa-Chhota Nagpur and Eastern Mysore the density is slightly higher, because of their mineral wealth, while in some of those of Central India comparatively lower, owing to broken relief.

The lower density which prevails on the Deccan Plateau when compared with the plains is primarily due to the less favourable configuration of the surface. The undulating plateaus of Central India and the interior of the Peninsula are broken by ranges of residual hills, sometimes bare and stony and sometimes forest-clad, and are intersected by rivers and streams flowing in many deeply cut valleys. There is little scope for continuous cultivation over large areas.

Climate.—Of the climatic factors, the most important in the case of our agricultural country is "rainfall," which more than anything else determines the density of population. The importance of our monsoon rains is suggested by the denser populations of eastern and western coasts and by the fact that the Ganges Valley is marked by a population-density greater than all but a few other regions of the world. Subject to some modifications and

8. Food Planning for four hundred million, p. 193.

limitations, there is a distinct general correlation between the quantity of rainfall and the density of population. The densest areas are those which have a heavier rainfall than in any part of India except Assam where large tracts of hills and forests reduce the population in proportion to the area. Similarly two of the least populated areas, Rajputana and Baluchistan suffer from great paucity of rainfall. Both of them are deserts. The researches of Sir Aurel Stein in the latter country throw an interesting light on the relation between rainfall and density. He has collected evidence to support that it was once a prosperous country carrying a much larger population when the rainfall was heavier.

The sharp contrast between the extremes of density in Eastern Bengal on the one hand and the sparsely inhabited areas in the plains of the lower Indus Valley on the other, is largely due to the unfailing abundance and permanent deficiency of rain respectively. Between these extremes, there is every grade of density depending, to quite a large extent, on the gradation of rainfall. Moderate densities on the Deccan Plateau, apart from the effect of configuration, are also in part explained by the comparative lightness of rainfall. The rainfall, while ordinarily sufficient for cultivation, lacks stability in respect both of its seasonal and local incidence. Complete failure of the rains such as that of 1900, over this part of India, would produce intense and wide-spread famine, while badly distributed rainfall would cause local scarcity which, if carried from year to year, as in parts of Karnatak, would seriously retard the prosperity of the tract. The same is true of the unirrigated portion of the Ghaggar and the Indus plain.

Although good rainfall is conducive to successful cultivation there is a point beyond which an additional quantity is no longer beneficial and may be injurious. Provided that it is properly distributed, it appears that an annual precipitation of 40" is sufficient in most parts of India, and that it is only when it is less than this or is badly distributed, that differences in the amount of rain received have any marked influence on the success of cultivation and consequently on the density of population.

Malaria is the chief agent of mortality in India and its normal intensity seems to depend, to a large extent, on the climatic conditions of heat and dampness. Besides the western districts of Bengal it is specially prevalent in the sub-montane tracts of the Tarai region of northern India, and in the hilly and forested portions of Central and Southern India. In Assam the country is extremely

malarious. All these areas are therefore thinly populated. The question of unhealthiness is also a serious one in Western United Provinces and Eastern and Northern Panjab. Here also the growth of population is retarded, not because the limit of the soil capacity has been reached, but on account of the ravages caused by malaria.

Conversely, in arid desert regions, even drinking water for men and animals is scarce. Water-table is very low. So in the Thar and Thal deserts the small population centres round the few wells that have been constructed here and there. The settlements avoid the sand-dune areas.⁹

Soil.—The value of land and the density of rural population vary greatly as a direct result of the differences in the fertility of soil, but this is true only where small areas are considered, more specially of regions where the water-supply is adequate and equally abundant. But the general distribution of agricultural population and prosperity bears little relation to the soil. Broadly speaking, in India the soil itself counts for very little as compared with the rainfall or the configuration of the surface in determining the variations in the density of population. The reason is that the productivity of a land does not necessarily depend upon natural soil fertility. In Western Europe where water is plentiful, large areas of infertile soil have been made extremely productive by the application of fertilizers. In India, lands gifted with natural soil fertility but lying in dry zones could not be made productive except by the provision of adequate water-supply. The lower valley of the Ganges and that of the Indus are alike alluvial formations, both rich in natural soil fertility, but the former is one of the most densely and the latter one of the most sparsely peopled tracts in India. The explanation is found in the difference of productivity resulting from great contrasts of rainfall.¹⁰ The soil of the lower Indus valley is plastic clay, with water it develops into a rich mould, without water it degenerates into a desert. On the Deccan Plateau the black cotton soil is considered to be very fertile but its productivity differs with the amount of water-supply. It is peculiarly retentive of moisture but when dry becomes very hard. If the rainfall is excessive the crops rot, if it is deficient the soil

9. See Sheet No. 38 P|11 or 44 P|15.

10. When broad regions are considered even the quality of the soil depends to a large extent on climate. Unfortunately the climatic effect is such that the best soils are found in climates which are dry. Heavy rainfall reduces the fertility of soils through leaching out of plant foods.

becomes almost unworkable. The crops are thus liable to damage both when the rainfall fails and also when it is in excess.

The sandstone and granite soils of the archaean plateau are arid. Here again the density and distribution is generally determined by the availability of water. While the soil, for its natural fertility, may not exercise a determining influence in the concentration of population, it is certainly an important factor in the driving of it, if it is infertile and not capable of being made productive by ordinary means. So it is that the alkaline and *usar* lands in the Indo-Gangetic plain are very thinly populated. It is very rare for a village to be found in the midst of such areas. The same is true of marshes.

Hydrography.—Rivers have different potentialities for human settlement depending primarily upon their utility for water-supply and transport, and the nature of floods. Man has been instinctively drawn to their banks and so we find that their valleys have generally supported comparatively a dense population. This is specially the case in the lower sections where the river ceases to carry and deposits large amount of fertile alluvium. The lower valleys and the deltas of the Ganges and the Indus as well as those of the Deccan rivers bear comparatively much larger population than their upper valleys. But even within these lower portions the density varies with the nature of the work of the river. There is an appreciable difference in the density of the Gangetic delta—old and new. In the delta of Eastern Bengal the rivers not only supply fertile alluvium and plenty of water but also drain the surplus and prevent waterlogging and unhealthy conditions which retard the growth of population in Western Bengal. Here there is a danger of floods on account of the interference with natural action of the river and the sea by the building up of embankments and sea-walls. Similarly in the Deccan Plateau the riverain area shows a greater concentration of population, but here not so much for agriculture as for domestic water-supply. As there are few wells, fluvial water at many places, stored in reservoirs, is very important for the maintenance of the people.

Devastating river floods introduce a condition repelling to settlement. Therefore the *Khadar* lands are very thinly populated. In India rivers are much swollen after the heavy monsoon rains, and the conditions are much magnified in the case of big rivers which have large catchment areas in the Himalayas as the Indus or the Sutlej. There can be no settled population within the reach of annual floods, or in the extent across which the river-

bed swings. From time to time the Indus suddenly shifts its course and covers the country with one vast sheet of water. So there has been very limited population in the valley of the Indus till we come to the lower reaches where water has long been harnessed by the construction of flood canals.

Ravine lands, formed as a result of gully erosion and excessive drainage on the flanks of the rivers like the Jumna, the Chambal and the Ganges are very thinly populated.¹¹ Similarly there is practically no population in the hill torrents area or Nalla zone at the foot of the western mountains.¹² Inadequacy of water-supply and difficulty of transport both prevent human settlement in these regions. There is, however, a chain of settlements found at the dry point at the end of the torrents or nallas.¹³ The Cho belt of Northern Panjab is very thinly populated for sand. There are only scattered huts near water-channels where agriculture is possible.¹⁴

Vegetation.—Forests, like mountains, are negative regions; i.e., regions which have obstructed communications and deterred settlements. The forested plateau of Shillong is very thinly populated like the forested areas of the Deccan tableland. The Sundarbans¹⁵ are absolutely devoid of habitation. Similarly the Tarai forests are almost uninhabited excepting scattered huts here and there in the clearings. As a rule in the forests the importance of human establishments is inversely proportional to the luxuriance of vegetation.

CULTURAL ENVIRONMENT

Irrigation.—Of the cultural environment the most important for the dry tracts of India is irrigation.¹⁶ It adds enormously to the density of population by increasing the agricultural output of the region. The dry area of the Indus plain as well as that of the upper Gangetic valley, owes a great part of the population to the circumstance that it has the most extensive system of irrigation of any part of India. For the success of cultivation the essential thing is water and it does not matter much whether it is received from rain or canals, wells or tanks. In the five canal colony districts

11. See Sheet No. 54 J|1 or 54 H|12 or 35 K|16.

12. See Sheet No. 39I, 34 K|15, 35 M|8.

13. See Sheet No. 54 A|14 or 34 K|14.

14. See Sheet No. 43 P|9.

15. See Sheet No. 72E, 53 O|5.

16. See Sheet No. 53 O|8, 62D.

of the Panjab, the population has grown from 1732 thousands in 1881 to 4,912 thousands in 1931—an increase of 281·8 per cent. In 1891, the Lyallpur district was a barren desert with a handful of nomads numbering only 15 to the sq. mile. With the opening of the canals in the following year cultivator immigrants flocked in large numbers. By 1901, it had a population of 187 to the sq. mile, which figure rose to 368 in 1931. The high density of the east coast of Madras, which gets only about 32 inches of rainfall, is due to irrigation. Here the density differs in the deltaic and non-deltaic tracts. It is a function of irrigation and goes hand in hand with wet cultivation. On the plateau settlements have almost certainly grown near the tanks.¹⁷ They are of great ritualistic and domestic use by providing permanent reservoirs and are the principal sources of water-supply. In Baluchistan settlements become more numerous in the *Karez* area.¹⁸ In the sub-montane districts of the Panjab and United Provinces there has been a higher density of population because of the high water-table and the resulting facility for the construction of wells. Where the perennial rivers emerge from the Himalayan mountains there is a chain of settlements. Not only do these provide a route into the mountains but here their waters are easily controlled by the natives. In the dry zone of *Bhabbar*, where water-table is very low, cultivation can be carried on by canals and small streams. Depending upon them there is in some cases a zone of scattered population between the Siwaliks in the north and the Tarai on the south.¹⁹ The huts show an interesting linear arrangement in sympathy with the direction of the water-bearing channels.

Cultivation.—Methods of cultivation and the crops grown have no insignificant bearing on the density of population, as they affect the food-supply on the one hand and the purchasing power of the agriculturist on the other. Part of the growth of population in the colony districts of the Panjab may be attributed to intensive farming, leading to an increase in the production of wheat and Egyptian Cotton.

Rice.—In Eastern India, because of the great stimulus given to vegetation by the high summer rainfall and temperature, many plants have developed which complete their cycle of life in a few

17. See Sheet No. 56 K|13.

18. See Sheet No. 34 J|16.

19. See Sheet No. 53 O|3.

months and ripen simultaneously. In parts of the United Provinces, Bihar and Bengal, rice matures in 60 days i.e. about half the time needed by most varieties of wheat. Three crops are raised in Northern Bihar, and even four or five in deltaic districts of Eastern Bengal and Madras. Its rapid growth and large output value makes it pre-eminently suited to cultivation on a small scale. Rice lands—lower-Gangetic Valley and coastal steeps, thus support a dense population. It has been epigrammatically stated that in Bengal the population is in exact proportion to the productive power of soil measured in terms of rice. This influence of rice is clearly brought out in the Central Provinces. Here though rice is not such an important crop as wheat or cotton, yet the densities are far higher in the rice-growing districts.

In the drier parts of India barley and jowar provide food for the bulk of the poor people. Though the food value is much less, their yield per acre is greater than that of wheat. So a higher percentage of these crops amongst the food grains is indicative of the pressure of population on subsistence and is likely to correspond with a denser population. This statement is not correct for those dry areas where barley, jowar or gram are the only crops that can be widely grown.

Cash crops.—The density of population exercises a considerable influence on the proportion of the more paying or cash crops to be sown, though the converse may not be true. The ordinary cultivator in India looks to the *Khari* or Autumn crop to provide him with food and the *rabi* or spring crop with money for other necessities of life. The larger his family the greater the margin of profit that must be secured from his holding to support them and hence he must grow a larger area of the more paying crops like sugarcane, cotton, tobacco or vegetables.

A right combination of cash crops and heavy yielding food crops furnishes the stable economic basis of an exceedingly high rural density of population in several areas e.g. rice and jute in Bengal and Madras deltas, cotton and wheat in the Panjab and Central Provinces, rice and cocoanut in Malabar. This effect finds a very good illustration in Travancore. Here the combination of paddy and tapioca and money crops such as tobacco and pepper supports a mean density of 1486 per sq. mile of the net cultivated area. The response to population increase is an expansion of the area under pepper and cocoanut more than under paddy and tapioca, the chief food crops, and importation of rice from Burma.

Communications and commerce.—Just as the rural density of population is determined primarily by the agricultural possibilities, the urban density is mainly governed by the commercial and industrial possibilities. In the modern era of international commerce these two later factors are influencing a great deal the trends of human distributions and have brought about some appreciable changes in our population pattern and cultural landscape. As the following figures show there has been a noticeable tendency for the population to be more and more urbanized during the present

Percentage of rural and urban population in India.

Year	All India.		British India.	
	Rural	Urban	Rural	Urban
1901	90·21	8·89	90·5	9·5
1911	90·65	9·45	90·6	9·4
1921	89·70	10·30	89·9	10·1
1931	89·00	11·00	89·1	10·9

century. This urbanization is partly due to the influx of labour to the industrial centres and partly to the growth of villages into market towns with the development of communications and commercial facilities, the latter being bound up with the former. Lyallpur only a small village of 9171 persons in 1891 attained a population of 42922 in 1931 as the principal market of the canal colonies in the Panjab. In Montgomery the population has grown 723·3 p.c. between 1881 and 1931. All the road and railway junctions and principal ports have considerably gained in numbers according to the importance of their position. Thus the old even or flat pattern of population has now become specked with nucleations of various sizes. When compared with Western Europe, these nucleations are much smaller in size and lie farther apart. The greatest of them Calcutta has only 1,196,734 persons, and in our area of 1,800,000 sq. miles there are only 2 cities with a population of more than one million and 39 with a population of 100,000. Of these latter cities U.S.A. with about one-third of our population has 70 and Great Britain, with about one-ninth of our population has 56.

Our great sub-continent presents a very varied physical environment. For facility of trade, on a change from one type of environment to another the settlements are found to be com-

paratively numerous and the population denser. For example there is a chain of market towns on the north-eastern margins of Rajputana²⁰, Sirsa, Fatheabad, Hissar and Hansi. Similarly there is comparatively a larger number of settlements on the margins of Central Indian forests.²¹ From all these marginal settlements routes negotiate with the interior.

Industry.—Industrialization is the chief creator of large towns and cities. Calcutta, Bombay, Cawnpore, Nagpur and Bangalore all owe a great proportion of their population to large scale industries. The relation between urbanization and industrialization is evident all over India and is visible not only in mineral but also in agricultural industries. But many of our agricultural industries like sugarcane and cotton support a floating population, the seasonal rythm of cropping being reflected in seasonal human migration.

In the sugarcane belt of northern India since the imposition of protective tariff in 1931 there has been an increase in the population and many new village sites have sprung up. The tea industry in Assam has been responsible for a large number of immigrants and there has been a steady increase in the density of population of this province owing to this influx. In Central provinces the greatest density is found in the Maratha Plain devoted to cotton industry.

In the mineral belt of Chhota Nagpur and Orissa, population has grown with the exploitation of minerals, Jamshedpur, the centre of iron and steel industry in India, with a population of 56727 in 1911 rose to 83,847 in 1931.

TYPES OF POPULATION DISTRIBUTION.

An investigation of the different systems on which the population has formed itself into the microcosm, commonly known by the generic title "Village", is one of the most interesting subjects in the human geography of India.

The special basis of the Indian social organisation is essentially anti-urban. India is a country of villages; the cities of this immense agglomeration of human beings contain about 2 per cent of the population and the rural occupation is chiefly in the form of villages. The village community in its constitution is self-sufficing, an economy based on the extreme simplicity of wants and isolation resulting from very bad means of communication.

20. See Sheet No. 44 O.

21. See Sheet No. 54 G|N.E.

Village Types.—Meitzen in Germany and subsequently Maitland in England pointed out the major village types which were, as they still are, widely distributed in Europe. The types of Meitzen were *dorf* or nucleated village and *Einzelh*, which is strictly speaking a single homestead. This classification is based on the way in which habitation are arranged. In the first case they are grouped closely together into single large villages, in the other they are scattered widely occupying separate sites.²² The same classification may be easily applied to our own country. Two main types of rural settlements are found, (1) large compact villages in which the rural population is concentrated and (2) the scattered homestead. The former is the predominant type to be found all over India, excepting Malabar and large portions of Bengal and Assam in which characteristic settlements belong to the latter type. These types of distribution of population are the result of man's adaptation to a varied geographical environment. Water-supply, land forms, soil, climate, vegetation cover, conditions of security, agrarian system, social, racial and religious ideas, all play some part in determining the pattern of our settlements; of these again the problem of water-supply is the most important.

Relation to Water-supply.—Nucleated villages are the rule where the water-supply is limited while scattered settlements occur where water is plentiful and ubiquitous. In the upper Gangetic and Indus valley, the necessity of guarding against irregular and insufficient rainfall has been partly responsible for the maintenance of village groups. Where water could be got only by wells, the organised effort and capital required implied concentration of people and nucleated settlement.

In the arid areas of Rajputana, Sind or Thal small villages occur where wells could be dug²³ and villages are far in between as it requires large areas for the maintenance of population and the proper conditions for the digging of wells are not so easy to find. A very compact type of village is characteristic of the Panjab. The regulation of valley flood by means of primitive sluices, the boring of wells in the interfluves and the fear of invasion and robbery in pre-British days, all necessitated co-operation. The villages are generally large in the northwest of India. East of the Panjab, beyond the old routes of invasion the villages become smaller but

22. A third type "hamlet" is also recognised. It is a collection of separate huts.

23. See Sheet No. 43 G|14.

are spread closer together. In the Gangetic trough between the Himalayas on the one hand and the Deccan Massif on the other, the water-table is generally high and the land is honey-combed with numerous wells, lined and unlined, which provide plenty of water to vast stretches of fertile soil. Small village communities, therefore, cover the entire area of this loose mellow soil.

Further east in the area of heavy rainfall in Eastern Bengal and Surma valley or in the south, in Malabar and Travancore there is little inducement for the people to collect in groups. A diffusion of water and facilities of approach either by water channels or plenty of roads make it easy for the habitations to be scattered. Isolated houses or hamlets characterise the landscape.

In Eastern Bengal²⁴ there is no regular village site and the houses are very scattered, standing in the midst of gardens, surrounded by agricultural lands. They are sometimes erected in straggling rows along the high banks of rivers or in clusters on mounds, raised to a height from 12 to 20 feet, which form small islands when the country is inundated during the rains. These gardens become very few in northern Bengal.²⁵ In central and western²⁶ Bengal, though houses are seldom unduly crowded together, and each has its own patch of homestead land they are generally constructed on a single village site. Many of the villages are situated on the banks of silted up rivers and buried in mass bamboos and other vegetation and are very unhealthy. In Assam lowlands,²⁷ the houses are, as a rule, scattered over the rice fields and are rarely collected on a central site. They are generally found in groves of bamboos which dot over the cultivated rice lands.

In Malabar²⁸ and Travancore the whole extent of the country is dotted with isolated homesteads and it is difficult to define a village. It lacks the characteristics of the compact determinate village of upper India. It is difficult to say where one village ends and the other begins.

The relation between water-supply and village type is no less apparent on the Deccan Plateau. There are generally small compact villages found near the tanks and are farther apart than in

24. See Sheet No. 78 O|4.

25. See Sheet No. 78 F|7 or 78 P|2.

26. See Sheet No. 79 A|3.

27. See Sheet No. 78 B|3.

28. Sheet No. 48 L|14.

the plains of northern India. The archaean rocks do not admit of much sinking of wells as in the soft soils of the Indo-Gangetic plain. But tanks or artificial reservoirs have been built here and there with the help of dams.

The canal colonies of Panjab provide an important variation in the cultural landscape of India. Here since the introduction of canal irrigation duly planned and regularly spaced settlements have grown up in an area which was formerly devoid of waters.

Agriculture.—In an agricultural country the size and type of the residential unit of the rural population should naturally be determined by the exigencies of agriculture. The nucleated village is the evident result in an agriculture community where cultivation is based on small fragmented holdings. The supervision of the fields lying scattered over a large area necessitates for the farmer and his blood relations a central site for living. This has been one of the important factors in the growth of our nucleated settlements.²⁹

Land-tenure.—The compact villages of upper India and the scattered settlements of east India also reflect partly the difference in land tenures. In Bengal and Assam the land settlement is permanent and not subject to periodic revision and so the population does not require the maintenance of minute administration records and it scatters itself as it pleases within the limits of the survey unit, the so called Mauza.

Communication.—Facility of communications becomes an important consideration with water-supply in determining the site and type of settlements in mountain and forest areas. In the mountains the settlements are, as a rule, of dispersed type³⁰ found along accessible river valleys, but even compact settlements are not altogether absent. The conditions are generally the reverse of those in the plains, that is where the population is thickest it is found in concentrated villages as on the North-east frontier, whereas when it is very thin it seems to be spread out in isolated homesteads or scattered hamlets as in the Simla Hills. In the forest as well, the habitations are of the scattered type and huts generally follow the trackways in the clearings.

29. See Sheet No. 44 A|16.

30. See Sheets No. 38 P|14, 43 G|13, 43 P|13.

The existence of good roads is responsible for the recent tendency of *ribbon* development of the principal cities like Delhi and Lahore. Isolated dwellings stretch for miles outside the Municipal limits. The land is comparatively much cheaper and the inhabitants try to save municipal taxes, while enjoying the amenities of city life.³¹

Similarly in Calcutta, the facilities of cheap electric transport are reflected in the development of the city in the direction of principal railways. In Bombay which lies on an island, this tendency is not so marked.

31. See Sheet No. 79B. Recently in 1941, an Act has been passed to control the ribbon development of Delhi.

A Resume of the Trends of Population and Crop Production in the U.P. After 1931 *

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The world is passing these days through the most critical times, and among so many political and economic problems the interest in the population problem is also growing. In the western countries the prospect of the decline of population in the near future has received much attention of late. In the East, on the contrary, the apprehension of over-population has created a realization of the vital importance of the problem. In India, too, the pressure of a rapidly increasing population is the most fundamental problem of the day. It underlies most of the country's perplexing difficulties and seems to justify the efforts that are being made to improve agriculture and reclaim waste land, to develop manufacturing, and to expand trade. It is also gradually catching the attention of the public, and in the press and periodicals it is discussed by economists and publicists.

Sir Robert McCarrison in his introduction to an article on 'Dietetics, food and race' has said about the population of India as follows:—

"The proper nutrition of her people, the adjustment of food supply to the population, and of the population to the food supply, the provision of efficient sanitation in her towns and villages: these are India's needs, all else is of secondary importance.

"....the diet of many millions of the Indian people is not such as can maintain physical efficiency and health. They are condemned, from their mother's wombs, to a sub-normal or diseased existence.....".

Our observations of the Indian life make us share the opinion held by Sir Robert McCarrison, that the increase of numbers is a matter of serious concern if our means of subsistence have fallen short of the needs of our people. A wave of discontent has created

* A paper contributed to the Geography and Geodesy Section of the 28th Session of the Indian Science Congress, Benares, 1941.

a whirl of perplexities and prospects which acquire a more ominous significance owing to the fact that what is at stake is the future of a nation of nearly four hundred millions, one-fifth of the human race. These four hundred millions have to be raised from their present subhuman existence to a level worthy of human beings.

The Public Health Commissioner with the Government of India in his annual report of 1933 stated: "if existing conditions continuethere seems little doubt that by 1941....the population of India will considerably increase the estimate of four hundred millions....." He also quotes the words of the late Mr. Joseph Chamberlain who "at one stage of his political career spoke of 'three acres and a cow' as providing a sufficient standard of living for the average English agricultural labourer....." India has the area of 667 million acres and if we assume, though it may be absurd on the very face of it, that the whole area is available, this works out at only 2.44 acres per head of the population. If we take up the cultivated, fallow and culturable areas, which sound more reasonable, they will amount to 481 million acres which give only 1.75 acres per head of the population. But some land must be left as fallow and some proportion must be provided for crops other than food. In 1933-34 the total acreage under food crops amounted to only 206½ million acres. This gives only 0.72 acres per head; and thus it is obvious that a land of such dimensions cannot be sufficient to provide subsistence for its human beings. In an agricultural country like India according to Dr. R. K. Mukerji one acre at the least is indispensable for the sustenance of one person.

In this paper we have to confine our attention to the problem of growing population of the United Provinces. The Public Health Commissioner in his Annual Report of 1937 recommended the establishment of special committees in provinces to study the population problem and educate the public. To this suggestion we would like to add that the special committees so formed should work in co-operation under the direction and control of a central planning body on a national scale.

In the United Provinces the statistics of births and deaths for the more recent years indicate that the population of the province is increasing by about 600,000 persons every year. The full magnitude of the population increase can perhaps be expressed best in terms of the demand upon the food supply if there is to be a maintenance of the existing standard of living though it may be so low. As the inhabitants of the province are taking a variety of food, it is not easy to fix up dietary standards. Therefore, demand for the quan-

tity of food cannot be ascertained so easily with the information available at our disposal. But it can be found out that in 1931 the area under food crops per head was 7.79 acres. To meet a new pressure of 600,000 persons annually on food supply, and consequently on land, the United Provinces must add nearly 474,000 acres every year to the existing area under food crops. The United Provinces have no frontier of empty land available for the taking. If production is to be increased all waste land must be rendered productive, swamps reclaimed, forest cleared and even the mountain sides and steeper slopes must be terraced to make room for further increase of cultivation, new irrigation systems must be built to safeguard against the vagaries of nature, or greater crops must be forced from the soil—always in the face of greater and greater obstacles.

If the land cannot be made to maintain the increasing numbers some new means of support must be explored. They must turn to commerce or manufacture, or they must seek a livelihood elsewhere. If these outlets prove impossible the United Provinces must either check the population growth or be faced with a heavier and heavier pressure on the means of subsistence and a resulting decline in the already low standard of living.

The United Provinces as regards population is the second largest province of India. The most outstanding characteristic of the U. P. is the slow growth of their population. The growth has not only been slow but in some decades there was actually a diminution of population. The census reports of the Provinces hold the occurrence of famine and outbreaks of epidemics responsible for the reduction in the growth of population.

Year.	U. P.	Br. territory	percentage Inter-censal variations.
1881	44.87	43.77	—
1891	47.68	46.60	6.2*
1901	48.47	47.31	1.7
1911	47.99	46.80	-1.1
1921	45.50	45.37	-3.1
1931	49.61	48.40	6.7

The British territory of the U.P. had a population of 48,408,763 in 1931. During the period of fifty years, 1881 to 1931, the popu-

* A certain proportion of this increase was due to better enumeration and the real increase has been estimated at 5.3%.

lation has increased by 10·6%, the greater proportion of which occurred during the last decade. The following percentage figures for the increase of population in other provinces for the same period of fifty years indicate that the U.P. are far behind them in this respect :—

Bengal	38	per cent.
Bombay	32	per cent.
Panjab	37	per cent.
Madras	51·6	per cent.
C.P.	35	per cent.
Bihar & Orissa	26	per cent.
U.P.	10·6	per cent.

After 1931, the increase of population, it seems, has been still greater than that of the last decade. The amount of increase can be calculated from the balance of the number of births and deaths and emigrants and immigrants. The figures for migration are not kept for individual provinces in India, and moreover the records of births and deaths are not absolutely correct. The difference between the natural population calculated on the basis of vital statistics, and the actual population enumerated at the census is the algebraic sum of the errors in vital statistics and of the balance of migration. However, we shall discuss the natural increase of population based on the vital statistics of the province, and the difference between the natural and the enumerated population has not been very high as to mislead us regarding the general trends of the growth of population.

The birth and death rates of the United Provinces clearly establish the fact that the population has been keeping up at a very high cost of human life.

Birth and Death rates of the U.P. calculated on the Census population of 1931.

Year.	Birth rate per mille.	Death rate per mille.	Difference.
1931	35·60	26·97	8·63
1932	34·66	22·23	12·43
1933	39·22	18·69	20·53
1934	36·74	26·75	9·99
1935	36·04	24·78	11·26
1936	38·99	22·61	16·38
1937	35·92	21·38	14·54
1938	36·79	25·82	10·97

Whereas, in comparison with the birth and death rates of other provinces of India, too, the U.P. maintain high rates; while as compared with other countries, the birth and death rates of the U.P. excepting a few countries like Egypt and Palestine, are tremendously high.

Country or Province	1937		
	Birth rate per mille	Death rate per mille	Difference.
British India	.. 34.5*	22.4*	12.1*
United Provinces	.. 33.5*	19.9*	13.6*
Panjab	.. 42*	21.3*	20.7*
Bengal	.. 33*	23.6*	9.4*
Madras	.. 36*	22.3*	13.7*
England and Wales	.. 14.9	12.4	2.5
Federated Malay States.	37.8	19.9	17.9
Japan (1936)	.. 29.9	17.5	12.4
Palestine	.. 41.6	18.9	22.7
Egypt (1936)	.. 44.2	28.9	15.3

The fluctuations in the number of deaths have been greater than in the number of births and the increase of population has been remarkably high in the years 1933, 1936 and 1937.

Year		Births	Deaths	Increase or decrease of population
1931	..	1,723,434	1,305,508	+417,926
1932	..	1,678,072	1,076,225	+602,247
1933	..	1,898,534	904,888	+993,646
1934	..	1,778,792	1,295,094	+483,698
1935	..	1,744,836	1,199,653	+545,183
1936	..	1,887,598	1,094,677	+792,921
1937	..	1,738,906	1,035,003	+703,903
1938	..	1,781,118	1,249,988	+532,130

* Calculated on the estimated population of 1937.

The quinquennial averages of births and deaths are 1,786,250 and 1,172,883 respectively. If we suppose, as we already know, that health and food conditions have remained almost the same during the years 1939 and 1940, the number of births and deaths will also remain the same as in the past years or in accordance with the quinquennial averages. Moreover due to the efforts of the Public Health Department there is every likelihood that the number of deaths will decrease. On the basis of these quinquennial averages we can have an idea of the extent of the increase of population. Thus if we adopt the quinquennial average of births for the years 1939 and 1940 the total increase of population amounts to 6,296,989 persons during the decennium 1931 to 1940, with an increase of 729,699 persons every year. The total population by the end of 1940 will swell to 54,705,753. The estimates of total population of the U.P. for the inter-censal years have been made by the Public Health Department, which show a gradual but steady growth of population in the province. By 1938 the population touches the figures of 52,994,705. Allowing about 1,705,753 for the margin of error in the registration of births and deaths and migration, the total population comes to about 53 millions. We have allowed a considerable number for the errors; anyhow, it can safely be stated that there will be an approximate increase of more than 4½ millions in the period 1931 to 1940.

We have mentioned that the population increase must be accompanied by a corresponding increase of area under food crops or resort should be made to intensive cultivation for taking out greater quantities of food stuffs, or industries must be started to absorb the surplus population.

The following extract from the Annual Report of 1934 of the Public Health Commissioner with the Government of India will throw much light upon the problem of supplying the excess of population with subsistence and the estimation of yield from the land:—

“In no direction is our lack of accurate data more evident than in a consideration of the population problem particularly in its relation to food production.....

“Crop production is really estimated by multiplying together ‘area in acres,’ ‘standard yield’ and ‘seasonal factor’.....the area in acres would be of great value, for this factor is relatively static (at least in the U.P.) except for increase due to new irrigation projects. The seasonal factor varies from year to year, is mainly

dependant upon metereological conditions and cannot, therefore, be standardized. There remains the standard yield, the most elastic of the three on which depends mainly the answer to the question 'can increased population be balanced by increased food production.' In dealing with this question there are several points to remember. Agricultural research is continuously showing the way to increased yields. In a bad year standard yields are put down—they are seldom put up in a good year. Where figures can be checked as in the case of cotton, estimates are found to be almost 25% below the truth.

We have seen that the area under food crops per head is much below the optimum estimated for a monsoonic country like India. H. E. Lord Linlithgow, the Viceroy of India, once advocating the need for an extension of irrigation in the country, emphasized in his speech the graveness of the population problem and remarked: "The population of India is expected to increase to 400 millions by the census of 1941, and it is increasing at the rate of about 4 millions a year. Only three quarters of an acre is under cultivation per head of the population. These facts are staggering, and you will agree with me that they must give matter for serious thought to all thinking men and women in India."

We have to conclude from a close examination of the crop statistics that the fluctuations are wider in crop areas than in the case of the increase of population and that the total crop area, double cropped area or the area under food crops is not rising steadily. This is mainly due to the precarious character of the rainfall of India.

(*Million acres*)

Year		Total Crop area	Double cropped area	Food crops area
1930-31	..	43.02	8.11	38.16
1931-32	..	43.11	7.99	38.05
1932-33	..	42.26	7.22	37.10
1933-34	..	43.22	7.84	38.05
1934-35	..	42.70	7.67	37.57
1935-36	..	42.85	7.58	37.26
1936-37	..	44.39	8.85	38.19
1937-38	..	44.04	8.50	38.17

Although the total crop area has increased by about one million acres from 1930 to 1938, the increase is being more remarkable in the years 1937, 1938 and 1939. The increase is not uniform and moreover the area under food crops has remained almost stationary owing to the displacement of the cheap food crops by the more paying cash crops. Due to the increasing pressure upon land, fresh areas are being brought under the plough and there is an increasing practice of double cropping.

Under such circumstances a steadily increasing population cannot be kept on the same standard of living; and moreover, the uncertainty of the produce from the land further intensifies the problem of sufficient food production and of raising the standard of living. Here it will be justified to quote the words of the Public Health Commissioner taken from his Annual Report of 1934: "In the present state of our knowledge it is not safe positively to assert that food production cannot keep pace with population increase, although there is evidence to show that the 'ryot' is worse fed now than he was in earlier days. Rather is it probable that the absorption of food stuffs has, over a period of years, risen in proportion to the population. This cannot, however, be proved with our present statistics and there is great need for a general survey of food production in India."

Until such a survey has been carried out, the question of population cannot be satisfactorily determined. "The present economic condition of the majority of population of not only the U.P. but the whole country is remarkably deplorable, which presents a picture of the scantiness of food and low purchasing power in the under-fed and insufficiently clothed farmers and labourers. The Public Health Commissioner in the same Report also says that "If food production keeps pace with population increase, a critical situation may be avoided, but India needs more than this. A higher standard of living, with all that this brings in the way of improved health and welfare is a pressing need which can only be obtained, in a predominantly agricultural country by a considerable increase in food production or a pronounced drop in the annual increment of population."

But when we consider the agricultural and industrial potentialities of our country the hope of a better living and greater population is not a far-fetched one, and we may be prepared to believe that the U.P. are not yet over-populated. In such areas where the help of science has been taken in agriculture and industry the

standard of living, with the security of food supply and more money, has really been rising, as in the western United Provinces grid zone, where hydel and tube wells have transformed hundreds of acres of waste land into productive fields, cultivating valuable cash crops and heavy yielding food and fodder crops. The farmer there is well off fostering a sense of security and instigation for improvement. The various factors to which the degeneration of the condition of the farmers is assigned are firstly, the occupation of India by the British, which has created an atmosphere of calmness and peace, and fostered the increase of population by leaps and bounds; secondly, the gradual abolition of family system which has rendered the size of the holdings smaller and smaller and the production has become less remunerative. Thirdly, the rapid increase of population has been instrumental in the devastation of forests, with its consequences of soil erosion and ultimate infertility. Fourthly, the deterioration of the live stock has had an unfavourable influence on the health and well-being of the people. Although there may be other causes of this disturbance of economic equilibrium, we would finally like to mention the 'maldistribution' of population in the country which is a great menace in India. The density of population varies from 6.5 per sq. mile in Baluchistan to about 4,000 per sq. mile in some parts of the country. The variations in the density of different provinces also show a large range, from 129 in the N.W.F.P. and 137 in C.P. and Berar to 442 in the U.P. and 616 in Bengal. Similarly in the United Provinces the distribution of population is not uniform throughout. We have another factor which could justify the adoption of a deliberate population policy for the sake of our future generations; we mean the heavily unbalanced distribution of the population as between towns and villages. It is a well-known fact that 89% of the population of the country live in the villages and 11% in towns. Thus the distribution of population in the U.P. should also be considered as a problem of vital importance. "Recent years have witnessed increasing interest in respect of such matters as improved agricultural practice, marketing, nutrition, animal husbandry, irrigation and forestry research and the co-ordination of these studies in relation to national planning for improvement of the general standard of life is one of great importance than is generally realized." (from the Annual Report of the Public Health Commissioner with the Government of India 1937).

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Ganges Valley Tube-Well-Scheme *

By

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Utilising the under-ground water by means of tube-wells worked by electric power is a valuable asset in the irrigation of our area. It was in the year 1912 that attention was directed in India to pumping out subsoil water in sufficient quantities for irrigation. Tube-wells, worked by oil engines and yielding about 2 cusecs were erected. The system, being expensive and complicated, did not attract much attention.

The Western United Provinces, the area comprising the districts of Bijnor; Moradabad, Budaun, Muzaffarnagar, Meerut, Bulandshahar and Aligarh (measuring about $1\frac{1}{2}$ million acres) had hitherto remained without much irrigation water for the winter crops due to the shrinkage in the rivers in the winter months. The storing of Monsoon waters in the Himalayan reservoirs was not likely to prove useful. The only alternative useful for the purpose of irrigating this area lay in the exploitation of the under-ground water. Tube-wells worked by oil engines had already proved unattractive. The only solution lay in the making available the electric power at a series of points throughout the area at a cheap rate. The Ganges Canal Grid scheme that was initiated in 1929 made the exploitation of that idea feasible.

Before we describe the tube-well scheme in full, it is essential to say something about the development of the Ganges Grid scheme which made it possible to develop the tube-well scheme.

Ganges Canal Grid Scheme

Colonel Cautley who designed the Ganges Canal, placed on it at intervals a number of falls from 10 feet high in order to reduce the speed of the flow and thus restrict the scouring of the channel. The idea of developing electricity was gradually taking root and in the year 1913 a small power station was installed at Baha-

* A paper contributed to the Geography and Geodesy Section of the 28th Session of the Indian Science Congress, Benares, 1941.

durabad for the purpose of operating the construction of machinery at the headworks of the canal at Hardwar. The canal water supply in those days was very precarious and could not be looked upon as perennial, and was unable to serve as a permanent source of electric power. The hydro-electric survey made in 1919-1920 showed that the power on the Ganges Canal falls was available only for nine months in the year, that is excluding November, December and January.

When in 1926 the possibility of giving a continuous water supply in the Ganges canal had been established by the engineers, the question of generating electricity from the falls was reconsidered. This fact contributed widely to the evolution of the grid scheme. Since 1928 the grid scheme has made rapid progress. The period from 1928 to 1940 may be divided into three stages of grid development.

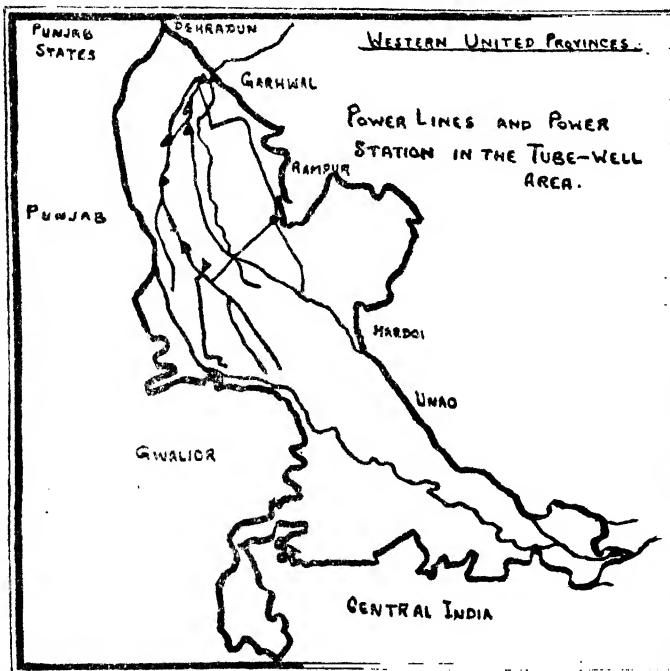
1st Stage—(1929-31).—This stage was one in which individual projects were sanctioned. The falls at Palra (8 ft.) were electrified in 1928-29. Here power was generated for pumping water from the Kalinadi to reinforce the Ganges Canal and electrify the town of Khurja. The fall at Bhola (12 feet) was used for electrifying Meerut, Hapur and Ghaziabad. Power generated here was also used for pumping water from the Ramganga at Serhara for irrigating the high arid land between Bijnor and Moradabad and also to electrify the larger towns in the above mentioned districts.

When these individual projects were carried out, it was decided to interconnect them with a view primarily to electrify the intervening smaller towns and secondly to give more security to supply of power.

2nd Stage—(1932-35).—During this period a series of minor steps were taken towards the development of the scheme. The small power station at Sumera was built in 1931-32 on separate foundations away from the canal. The Bhola and Bahadurabad power stations were enlarged. The Grid lines were extended to Aligarh, Hathras, Tundla, Dayal-Bagh and Kasganj. A system of rural branch lines was evolved and thus isolated farms within economic distance of the main lines were supplied with power. It was during this period that experiments proved that power could be used for pumping the water from the subsoil in places out of the canal reach and the evolution of state tube-well became a very important factor in the lay-out of the power lines and transforming stations.

3rd Stage.—(1935 onwards).—During this stage it was decided to complete the project (a) by the installation of three additional hydro stations at Salawa, Chitalra and Miragajni, (b) to build a steam station at Chandausi to supplement the flow of the canal for generator current at the time of maximum demand and (c) electrify the southern parts of Moradabad and Budaun districts. The stations mentioned above have commenced operations.

In the appended map we show the present system as it is to-day comprising seven canal power stations of (1) Bahadurabad, (2)



Miragajni, (3) Chitalra, (4) Salawa, (5) Bhola, (6) Balra and (7) Sumera, supplemented by various local oil engine stand-by plants and the steam station at Chandausi.

In the rural areas with which we are greatly concerned current is sold to a farmer at a flat rate of 1 anna per unit for agricultural purposes.

The demand for supply of cheap power in small quantities in scattered private farms has always been on the increase. A rural branch line system was introduced for this purpose; and this branch line system has been rapidly expanding. The number of

consumers is 382 at the present day, while the corresponding figures for the year 1932-33, was only 3.

In order to encourage the electrification of cottage industries, it is proposed to introduce a lower rate per unit. Efforts should be directed towards development of electricity in the rural areas and an increased demand will make it possible for the authorities to reduce the price. The most important feature of the hydro-electric scheme is that when once the initial expenses have been incurred the cost of supplying additional power is negligible, and consequently the more power that is required, the cheaper it can be supplied.

Tube-wells.

When the first stage of the Grid Scheme was completed in 1931, many privately owned tube-wells were electrified. Many new tube-wells for irrigational purposes were erected by the Government.

An experimental canal getting its supplies from larger wells was constructed in 1931 at Dingarpur, Moradabad district. There was incessant demand from the cultivators for a rapid expansion of the tube-well scheme. Experiments showed that the cultivator would prefer the tube-wells and would pay for them rather than use his own bullock-operated wells. The Government decided to complete 1,500 tube-wells in three annual stages. A so-called development circle was formed and 1,418 sites were located.

The allocation of the wells to the various districts is approximately as given below (during 1937-38).

Division one.—East of the Ganges :—

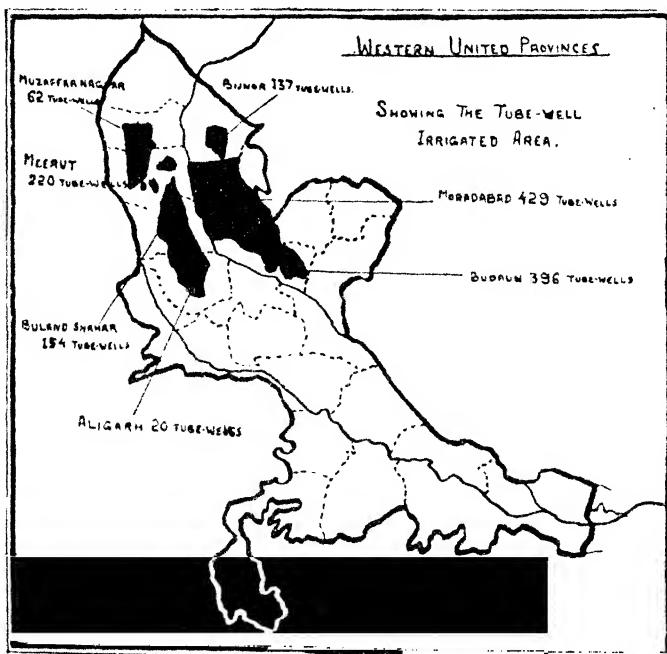
Bijnor	..	137	Tube-Well.
Moradabad	..	429	" "
Budaun	..	395	" "
		<hr/>	
		962	
		<hr/>	

Division two.—West of the Ganges :—

Muzaffarnagar	..	62	Tube-Well.
Meérut	..	220	" "
Bulandshahar	..	154	" "
Aligarh	..	20	" "
		<hr/>	
		456	
		<hr/>	

To these must be added 44 as miscellaneous. This brings the number to 1,462. In the appended map I have tried to show the area irrigated by tube-wells in every district.

Now we may study each district under the scheme separately and see how far the introduction of tube-wells has benefitted their agriculture.



Bijnor. With the exception of the small local canals the district has remained without irrigation. Masonry wells are not feasible to run as they involve a high running expense. Double-cropping was not profitable as the winter crops, sometimes even the summer crops, had to go without water.

The 1937 Tube-Wells that have been erected there command an area of about 270 square miles of the cultivated area. Further developments are very desirable.

Moradabad. Except for the area of about 100,000 acres commanded by the Ram Ganga Canal, the district has been devoid of irrigation. The 429 Tube-Wells command 840 square miles or 56% of the total cultivated area.

Budaun. Budaun has always been very unfortunate in respect of canal irrigation. Although it is surrounded by canal irrigated districts, it itself has never known the benefit of canal irrigation. 396 Tube-Well command 810 square miles out of a total of 1,831 square miles. Tube-Well are a boon to the district, the soil being very fertile. Further developments may be considered.

Muzaffarnagar. The Loi tract lying between the Hindan and the Kali Nadi is out of the canal range. 25 wells have been sunk in the southern part and 37 in the northern part of the area.

Meerut. It is the greatest canal irrigated tract, being commanded by the Eastern Jumna Canal, the upper Ganges Canal and the Anupshahar branch of the Upper Ganges Canal. The 220 Tube-Well command an area of 316 square miles of the drier parts in addition to the area irrigated by canals.

Bulandshahar. The central portion between Kali Nadi and Nim Nadi has hitherto remained without any canal irrigation. The 154 Tube-Well command 230 square miles of cultivated land of a total of 540 square miles.

Aligarh. The only part that has been included in the scheme is the northern portion of the tract lying between the Kali Nadi and Nim Nadi and forming a continuation of the Bulandshahar tract between the same rivers. Formerly 96 wells were proposed but only 20 have been sunk.

The State Tube-Well project commands about 2,900 square miles of country comprising some 1,462,000 acres of cultivated land and it is estimated that in times of drought, the Tube-Well will be able to water :—

Winter crops	..	482,460	acres
Sugarcane (Summer)	..	182,750	"
Other Summer crops	..	87,720	"
	..	752,930	acres

The danger of a fall in the subsoil water is extremely small. There has been no permanent fall in the water level of these districts where intensive pumping has been in operation for several years.

The average charges in the two zones are the following. (these charges are for the whole season of one crop and not for one watering only or for the volume of water used):—

One watering in the case of sugarcane means about 110,000 gallons per acre, while in the case of wheat and other crops it is 88,000 gallons per acre. Sugarcane requires about five waterings while wheat and other crops require one to two waterings. I have not taken the case of rice as not much of it is irrigated and no definite figures are available.

<i>Eastern zone.</i>		<i>Western zone.</i>	
	Rs.		Rs.
Sugarcane ..	6 13 0 per acre	Sugarcane ..	11 0 0 per acre
Other summer		Other summer	
crops ..	5 0 0 ..	crops ..	5 8 0 ..
Winter crops	2 0 0 ..	Winter crops	5 8 0 ..

The importance of this development will be realised when we know that out of 28,000 kilowatts for which the Ganges Canal Scheme provides, more than 12,000 kilowatts are allotted to the State Tube-Well. The project has within its fold 3,000 miles of distribution canals and about, 1,000 miles of inspection roads along with residences, offices and other buildings.

The Tube-Walls also supply water to the Upper Ganges Canal.

Such then are the brief details of the twin schemes, the Upper Ganges Canal Hydro-Electric Grid Scheme and the State Tube-Well Scheme.

The author questioned many farmers as to their opinion about the utility of the Tube-Well and not one of them uttered a word against them. They get water from Tube-Well for all purposes which saves a lot of their time and worry. The cultivator will never grudge what he pays for water and for other facilities if he is left alone by the landlord, the moneylender and their extortionate dues. Some people have taken to criticising the rates. If somebody could criticise the action of the landlords and the money-lender, much more valuable results could be obtained. It will not be very wrong to say that most of these critics are landlords themselves and are aware of the pitiable condition the farmer exists in. They want to help him; but if they do it themselves, it means a monetary loss to them and that is why they take to criticism as the safest way of playing the role of saviours of the culti-

vators. As to the actual prices of power and water, it should prove that the price is controlled to a great extent by the degree of demand. The more power that is used, the cheaper it can be supplied.

And we shall be true in declaring in spite of all that the critics have to say, that if our area has made any agricultural development, it is in the introduction of the canals and tube-wells that have been for long our greatest need in times of drought and for winter crops. These projects have conferred an economic boon on the people.

State Tube-Well Irrigation Scheme and its Effect on the Rural Economy of the U.P.*

By

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The western districts of the United Provinces have for long been suffering from low and precarious rainfall. The amount of rainfall received in a year is very scanty and cultivation is almost impossible without the help of artificial irrigation. The region is also liable to suffer from unseasonable distribution of rainfall and there is susceptibility of sharp deviations from the normal.

The State tube-well scheme has been designed to irrigate the seven districts of Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Bijnor including tahsil Aonla of Bareilly district, Budaun and Moradabad in the Western United Provinces.

In 1926-27, the annual rainfall of these seven districts was below the normal. In the four districts of Muzaffarnagar, Meerut, Bulandshahr and Aligarh the average annual rainfall was only 25.24 inches which was 1.97 inches less than the average normal for the above districts. Bijnor district received 37.28 inches, while its normal is 43.48 inches. Similarly the districts of Budaun and Moradabad had 30.56 and 31.26 inches respectively, the rainfall of the former being 2.35 inches below normal while the latter received 6.48 inches less than its normal.

The season 1927-28 was one of plenty and the rainfall in all these districts was much above the normal, but the greater amount of water was out of season. Further examples of the vicissitudes of rainfall are to be noticed in the seasons 1930-31, 1933-34 and 1937-38. In 1930-31 rainfall was generally low and scanty; but in 1933-34 it played havoc in all the districts, and proved much detrimental to the existing crops in the fields.

In Muzzaffarnagar the rainfall of 1933-34, was 49.16 inches as against 27.97 inches in 1935-36 and 31.08 inches in 1937-38, the normal for the district being only 29.69 inches. The district of Meerut with a normal of 28.10 inches received 47.93. inches in 1933-34 as against 25.71 inches in 1937-38. In the districts of Bulandshahr and Aligarh also the rainfall was recorded as 56.09

* A paper contributed to the Geography and Geodesy' Section of the 28th Session of the Indian Science Congress, Benares, 1941.

inches and 49.90 inches respectively. In 1937-38 these districts received 17.86 and 16.43 inches, their normals being 26.00 and 25.09 inches respectively.

It may be concluded from the statement given above of the rainfall in the western United Provinces that there are wide fluctuations in the amount of annual rainfall. Moreover, from the monthly and daily rainfall figures it can be inferred that in some districts there is unusually large rainfall outside the regular season and the distribution of the rainfall, too, is uneven. There is another striking characteristic of this region that during the summer months violent and dry winds blow from the west which suck up all the moisture and in a year of drought spell ruin to agriculture.

The question of irrigation in these districts, therefore, is of vital importance. The districts of Muzaffarnagar, Meerut, Bulandshahr and Aligarh are situated in the Ganges-Jumna Doab from north to south; while Bijnor, Budaun and Moradabad districts lie between the Ganges and the Ramganga. Although portions of these districts are served by surface canals, the area now privileged with tube-wells had not the benefit of those works, and still there is no possibility of irrigating this area by means of gravity canals due to the seasonal shortage of water in the rivers mentioned above. The canal systems of these rivers are of more importance to the south-western United Provinces, where besides the greater scarcity of rainfall, tube-wells, if constructed, cannot be worked cheaply.

The problem in the United Provinces in 1931, when the electric grid scheme was in progress, was how to expand irrigation for the relief of these unprotected lands. The following two schemes were considered:—

(1) Storing surplus monsoon water in the upper Himalayan valleys, and (2) tapping the hidden water which was believed to exist in vast quantities in the sub-soil sands below the plains

The construction of reservoirs by no means seemed economical, and further the instability of the Himalayan rocks which results in frequent land slides, was another serious objection against the success of such dams for irrigation purposes. Moreover, the great amount of detritus brought down by the rivers could quickly deteriorate the capacity of the dams and from a financial point of view, too, such dams could not prove profitable to serve as a permanent solution of the problem.

The only alternative which could appear feasible was to pump water from the subsoil. Throughout the Gangetic plain from the

Punjab to Bihar nature has provided an inexhaustible reservoir of sub-soil water, the western districts of the United Provinces being most fortunate in this respect than the rest of the region. The depth of the sub-soil water in this zone is from fifteen to forty feet. The sources of this water supply are from underground flow from the Tarai; percolation from the local rainfall; and seepage from the adjacent canal-irrigated areas. Thus a boring of about 250 feet below ground will tap a sufficient thickness of water-bearing sand and will be an adequate source for the supply of water.

Keeping in view the problem of irrigating this dry region it was worth-while to try experiments to evolve some suitable and at the same time comparatively cheap source of water-supply to safe-guard the region against the scarcity of rainfall

The electric grid scheme was launched in 1929 and the first stage of the scheme was completed by 1931. It was with the development of this scheme that experiments with tube-wells were initiated. During the period 1931-34, 95 tube-wells were sunk, and worked commercially on experimental basis in the districts of Meerut, Moradabad and Bijnor. The experiments proved successful and it was discovered that a 1.5 cusec tube-well was most suitable for the purpose. In 1934 it was then decided to adopt electrical tube-wells, constructed and worked by the State, as a means of irrigation in the dry tracts of the western United Provinces where canal irrigation was impossible or difficult. A comprehensive survey was accordingly made of suitable sites for the construction of wells and a project for sinking 1,500 tube-wells prepared.

The progress of tube-well construction is given below:—

	Equivalent number of 1.5 cusec tube-wells to the end of each year					Actual No. of tube-wells
	1933-34	1934-35	1935-36	1936-37	1937-38	
Moradabad	28	88	346	429	429	445
Budaun	..	6	26	396	396	400
Bijnor	7	7	62	137	137	143
Muzaffarnagar	..	..	..	55	62	62
Meerut	18	74	180	220	220	232
Bulandshahr	3	6	138	154	154	154
Aligarh	..	..	..	6	20	20
Miscellaneous	..	..	..	..	44	44
 Total	 57	 181	 752	 1,397	 1,462	 1,500

The Ganges Canal Hydro-electric Scheme

The United Provinces is totally devoid of coal and petroleum and therefore, the only source of power which can be exploited is the water power. The application of electricity to agriculture and farming operations has made considerable headway in India. The United Provinces and Madras have in this respect led the way. It is due to the introduction of hydro-electric power in the United Provinces that experiments with tube-wells have proved successful and paying, as contrasted with other sources of power which are neither so cheap nor easy in operation. In the western United Provinces is the Ganges hydro-electric grid scheme which, by harnessing successively, five of the eight larger falls on the Upper Ganges Canal as load developed, has enabled power to the extent of 12,000 K.W., to be transmitted over eight districts, comprising a total area of some 12,000 sq. miles. Since 1935, however, the scheme has been enlarged, the total output of about 30,000 K.W. being aimed at, of which 16,000 K.W. are being allocated to irrigation and agricultural purposes.

"Power is transmitted by means of the main network at voltages of 66,000 and 37,000; the distribution stations located over the area from which a secondary series of branch lines run at 11,000 volts to energise the intervening tracts including the State tube-well systems and many isolated farms.

The initial objects of the grid scheme were to supply power to irrigation pumping stations for lifting water from rivers, flowing at low levels, for irrigating tracts hereto uncommanded by the existing canal systems. At the same time power was to be supplied to all towns and urban areas having a population of 5,000 or over in districts affected. Under this aspect of the scheme, power has already been supplied to eighty-eight towns for domestic and minor industrial purposes. Demand for electricity having been established in the area, arrangements have been made for expanding the supply of power by means of the tertiary network both to the State tube-wells and to farm installations," (from *Agriculture and Animal Husbandry in India*, part I, 1936, p. 256).

It will be fit to mention here of comparative advantages of tube-wells and canals as means of irrigation. In the upper reaches of the river, canal irrigation is facilitated by the steep gradient of the country; however, where slope is gentle, a comparatively long reach of unremunerative canal is inevitable before the watershed to be irrigated can be reached. Further canals offer many other

advantages on the country-side; for example, free filling of village tanks for cattle and the cultivation of grass and trees along the banks. At the time of drought canals can supply extra quantities of water, as the rivers which are snow fed usually yield ample water. But in spite of this, canal construction requires heavy expenditure and much water in the course of transportation is lost by percolation and thus the farmers have to take far greater quantities of water than is actually required. Also the river-fed canals must obviously traverse the entire length of the region from the foothills to the last field to be irrigated, regardless of the unsuitability of the intervening tracts or uselessness of the system. Besides the above, the canals occupy a considerable area which could otherwise be used for cultivation.

As regards the tube-wells, although the annual operating expenses are considerably heavier than those of a gravity canal system, but still there is an economic feature that it can be gradually developed without heavy expenditure and a halt can be called at any stage should the adverse circumstances so demand. Then the tube-wells can easily be sited at places of maximum demand and this flexibility enables the scheme to advance gradually with the minimum of outlay. In spite of so many advantages, tube-wells, in rice-growing regions cannot be economically run due to the high cost of energy required for the large amount of water needed for rice cultivation. Another objection against the tube-wells is that the water table will gradually sink and ultimately the scheme may be rendered futile when the sub-soil water will be exhausted. This will also increase aridity and desiccation in the region. But from a close study of the geological structure of the region and the evidence of the engineers regarding the borings into the sub-soil reservoir, there seems no danger for such an apprehension, provided the quantities of water taken out and the working hours of the wells are in accordance with the suggestions made by them.

In fully developed tracts the State tube-wells are spaced on an average at the rate of one per 2 sq. miles of culturable area and by 1941-42 they will serve about 2,900 sq. miles of country comprising some 1,462,000 acres of culturable land and in a year of drought they will protect 482,460 acres of Rabi; 182,750 acres of sugar-cane and 87,720 acres of other Kharif crops. The development of tube-well irrigation has mitigated, to a large extent, the rigours which nature has imposed upon the agriculturists in many of these districts and has stimulated the growth of population by increasing both agricultural productivity and agricultural security. In these districts,

the recent increase in the extent of double cropping has also been mainly due to the extension of irrigation by the State owned tube-wells.

The increasing pressure of population upon land has also been accompanied by an increasing importance of either heavy-yielding food crops, valuable commercial crops, or both. Among the cash crops sugar-cane is receiving more attention, while cotton of an improved American type is being introduced. For although the area under cotton has decreased, the better quality produced is more paying.

Muzaffarnagar.—In this district only the Loi tract situated between the Hindan and the Kali Nadi is outside the command of irrigation canals, where 62 tube-wells have been sunk. The quinquennial average of the cultivated area in the district for the period 1926-27 to 1930-31 was 701,767 acres or 67.3 per cent of the total area. The average double-cropped area was 151,442 acres for the same period. During the period 1933-34 to 1937-28, when the tube-wells were being constructed gradually, although the total area decreased, the average cultivated area increased to 729,066 acres and the percentage of the cultivated to the total area rose to 70.2. Similarly the average for the area cropped more than once increased to 176,207 acres. Sugar-cane seems to have gained much attraction, the quinquennial average for 1926-27 to 1930-31 was 101,204.2 acres while the quinquennial average for 1933-34 to 1937-38 has been 121,876 acres. But acreage under wheat and cotton has decreased; while the fodder crops and other food crops show a general increase of area under them. In spite of all this as there are only 62 tube-wells, which irrigate only a very small portion of the district, the increase or decrease of certain crop areas may be due to other causes. But the gradual increase of acreage under sugar-cane which requires a sure and good supply of water is decidedly hampered by the tube-wells.

Meerut.—The gross cultivable area of this district amounts to 2,062 sq. miles out of which about 1,362 sq. miles are commanded by canals and rivers. Certain intervening tracts remained dry and in these 220 tube-wells have been located to serve an area of about 316 sq. miles. There are four distinct longitudinal zones which have no canal facilities and the tube-wells are grouped into them as follows:—

(a) The Sardhana tract, comprising the non-canal irrigated areas between the Hindan and the Kali Nadi north of the Meerut Delhi road.

(b) The west Hindan tract between the eastern distributaries of the Jumna canal and the Hindan river to the north of the Meerut Baghpat road.

(c) The Hapur tract between Kali Nadi and the Main Ganges canal.

(d) The Bhatipura tract between the Kali and the Nim Nadis west of the Anupshahr branch.

The district statistics for cultivated area, area cropped more than once, acreage under wheat, cotton, food crops, fodder crops and sugar-cane show same tendencies as for the above district. The quinquennial averages, for the periods 1926-27 to 1930-31 and 1933-34 to 1937-38 are given below :—

Quinquennium	Cultivated area	Area		Wheat	Food crops	Sugar-cane	Cotton	Fodder crops
		cropped more than once	once					
1926-27 to 1930-31	1,60,721	235,031	62,274	954,023	148,461	57,578	170,045	
1933-34 to 1937-38	1,97,643	326,820	351,960	998,739	164,568	51,896	186,181	

The increase of area under sugar-cane, food and fodder crops and area cropped more than once has been well marked; while the cultivated area shows a slight increase and the acreages under wheat and cotton have diminished.

Bulandshahr.—The central tract between Kali Nadi and Nim Nadi comprising the Kuchesar-Jahangirabad-Shikarpur-Dibai region was not benefitted by canal irrigation. Here 154 tube-wells have been sunk to command an area of 230 sq. miles.

With the expansion of areas under cash crops, area under wheat has also increased in this district, which may be due to the fact that sugar-cane is not very important in this district; only about 59,566 acres being under cultivation. Cotton as in other districts has also decreased in area. During the period 1926-27 to 1930-31, 88,366 acres were under cultivation, the average for the period 1933-34 to 1937-38 shows a decrease of 4,085 acres. Except cotton, there is a general increase of area under almost all the crops, which is obviously due to the introduction of the tube-wells.

Aligarh.—There is only a small portion of this district under tube-well irrigation. 20 tube-wells have been allocated to the nor-

thern portion which serve an area of about 96 sq. miles. Under the state of affairs the crop area cannot be much affected by the tube-wells, but still they establish in the mind of the farmer, in the region where they have been sunk, a sense of security and instigation for improvement.

Bijnor.—The area commanded by the tube-wells is bounded by the Nagina-Bijnor road in the north, by the Ganges sand dunes on the west and by the Nagina-Moradabad railway in the east. 137 tube-wells have been sunk to irrigate an area of 270 sq. miles in the above region, the rest being either under canal irrigation or requiring more tube-wells. The area under tube-wells forms the most fertile portion of the district but the construction of wells here becomes almost unfeasible owing to the absence of intervening clay beds on which to found surface masonry works and brick cylinders.

In Bijnor also the cash crops have displaced the expensively produced food crops. The acreage under wheat during the period of 5 years from 1926-27 to 1930-31 was 164,060 acres, which has further diminished to 163,661 acres in the quinquennium 1933-34 to 1937-38. In the case of cotton the decrease of area will prove beneficial due to the introduction of a better type having better value. The area cropped more than once has increased to comparatively greater extent, while the areas under sugar-cane and fodder crops have also considerably expanded.

Budaun.—The central elevated tract having an area of about 1,831 sq. miles, bound in the east and west by the Ramganga and the Ganges valleys respectively forms the most fertile portion of the district for the plantation of sugar-cane in the north and improved varieties of cotton in the south. This area before the advent of tube-wells had not the privilege of canal irrigation. There are 396 tube-wells which command 810 sq. miles of the above area. There has been expansion of acreage under almost all the crops. The statistics for the quinquenniums of 1926-27 to 1930-31 and 1933-34 to 1937-38 are as follows:—

Quinquennium	Cultivated area	Area cropped more than once	Wheat	Food crops	Cotton	Sugar-cane	Fodder crops
1926-27 to 1930-31	880,354	118,394	288,292	921,496	23,167	24,683	21,173
1933-34 to 1937-38	970,153	127,962	325,898	991,975	24,050	41,610	23,863

Moradabad.—The Gangan-Ganges tract of about 1,500 sq. miles is entirely devoid of canal irrigation out of which 1,350 sq. miles are culturable. This district has the largest number of tube-wells, which are 400 commanding an area of 840 sq. miles of the above tract.

Quinquennium	Cultivated area	Area cropped more than once	Wheat	Food crops	Sugar-cane	Cotton	Fodder crops
1926-27 to 1930-31	1,036,928	125,966	355,021	992,542	54,689	35,737	73,508
1933-34 to 1937-38	1,085,197	128,701	372,677	1,001,056	89,288	27,753	86,453

The number of tube-wells here being considerably large, the crop production has been much influenced; and there is a rise of acreage under various crops except cotton which was, before the introduction of the scheme, of a poor quality, but which is being displaced by the improved varieties.

The coming of electric power benefits the farmer in more than one way. Improved methods of scientific cultivation can be introduced in these tracts easily where new crops are being planted or taking the place of the old. The seed farms can be run successfully and the farmers can be persuaded to use the improved seeds and can be made to understand the advantages of systematic manuring and crop rotation. In other regions they cannot find favour with the farmers so quickly in face of local customs and prejudices; but in these newly developed tracts there is every possibility of bringing improvements in agriculture on scientific basis.

From the above survey of crop production in the districts affected it is evident that in such areas which have a large number of tube-wells the acreage under food-stuffs and to a greater extent under cash crops has increased. Sugar-cane and wheat are replacing bajra and the ability of the farmers to pay such expenses which may be incurred in raising a better crop expands.

The coming of electric power and its consequent supply of water can also solve the problem of India's live stock. The weak cattle and indifferent milch stock are the outcome of poor breeds and inadequate supplies of fodder and water. The security of water-supply from electrical energy makes the farmer more prosperous and makes it possible for him to consider the fodder crops

and to keep his cattle in a better position. Many of the cattle which were used to take out water from the ordinary wells can now be utilized in many other agricultural processes and cartage. The introduction of tube-wells in the areas which were hitherto dry has also increased the working hours of the cattle, which makes the farmer think of them and feed them better. Moreover with the greater use of the cattle and the improvement of breed, as is being emphasised these days by the authorities concerned, the increasing milching capacity of the cows will foster the development of dairy industries.

Now-a-days, although there are numerous schemes for the rural uplift of the country, the primary object of rural development must be to rebuild the social, cultural and economic life of the countryside. For this purpose priority has necessarily to be given to agriculture. Cattle breeding and cattle welfare, cottage industries, rural credit and marketing, medical relief and mass education are some of the other problems to be tackled. The western United Provinces as has already been pointed out is a region of scarce and precarious rainfall and consequently the agriculture there entirely rests upon the facility and surety of water-supply. The region primarily depends upon agriculture, and cultivation is the main source of money for the majority of the inhabitants. There have been proposals for improved sanitation, improved manuring, improved village life and establishment of birth control clinics; but the real uplift of the village lies in providing a little more money for the villager to make him realize his position and think of improvement. Any other means of raising the standard of living cannot prove successful unless the means of subsistence are made sufficient and secure, and unless the produce from the earth or any other side-work is made to pay a surplus over the bare necessities of life to create a sense of security and stability among the poverty stricken farmers. This end cannot be achieved to its entire satisfaction under the existing circumstances, if agriculture is the only means to depend upon. For a surplus of wealth, cottage industries must be introduced and carried out side by side with agriculture.

Hydro-electric power is being utilized not only for the purposes of irrigation but also for processing of agricultural products. A certain development of electrified agricultural industries has been consequently possible. The full possibilities of the application of hydro-electric power for such purposes should be immediately explored. The tube-wells are supplied with transformers from which cheap electricity can be transmitted to small industries.

In view of this the introduction of sugar crushers and centrifugals, cotton gins, oil pressing Kolhus and other similar small industrial establishments is possible.

As regards mechanical cultivation there seems to be no limit at the moment for its possibilities. There is again no doubt that the application of scientific methods of cultivation with mechanical power involves a radical re-organisation of the present agricultural system. It is a fact that in some cases the introduction of mechanical methods reduces the costs of cultivation. This refers particularly to improved agricultural implements which are comparatively cheaper and capable of rendering longer and better service. Where extensive areas are at present lying desolate, the possibilities of large scale agriculture with the help of motor tractors, electrical implements and tube-wells, is by no means a far-fetched one. With the consolidation of holdings and rationalisation of the agricultural system, the possibility of scientific agriculture has practically no limits. But there is every likelihood that the introduction of power will release labour and intensify unemployment. For this, small rural industries must be organised with the development and adoption of power in agricultural processes.

The introduction of cheap electric power has really revolutionized both the agriculture and the industry of the region. It is not only a boon to the minor urban industries but it has also alleviated the lives of thousands of cultivators who were living perilously close to starvation due to uncertainty of crop production. Although it has been noticed above that the State tube-well system has made irrigation cheap and extended it to the more remote areas, where canal irrigation was out of question and where the sub-soil water as commanded by the farmers was entirely insufficient to remedy the scarcity or variability of rainfall, areas in the United Provinces which 5 years ago could produce only a few quick maturing crops such as bajra etc. now boast of sugar-cane, heavy yielding winter crops and rich fodder crops. Still as regards the question of increased production, it has long been realized that unless steps are taken to encourage the better fertilisation of the local soils and use precautionary measures to prevent soil erosion, there is grave danger of exhaustion of the soil by the cultivators repeatedly taking out rich crops which deplete the soil resources. This danger tends to be increased by cheap irrigation as temptation to grow the more valuable crops is greater. In these parts of the western United Provinces the gradual encroachment of desiccation and soil destruction is also threatening the crop production.

If adequate steps towards checking this increasing menace are not taken in time, the gradual erosion of soil will ultimately render the land, infertile and desolate. The chief sources of soil destruction in this region are floods, wind, excessive grazing of sheep and goats and deforestation. The Irrigation Branch and the Agricultural Department in conjunction are endeavouring to counteract this by organising the cheap sale of manures, imposing restrictions on the grazing of live-stock and encouraging the plantation of trees. Besides other methods of controlling the erosion of soil the most important is afforestation which will not only improve the climate but would provide wood for fuel and agricultural uses and grass for the live stock. The cow-dung which is not burnt as fuel could be saved to be used as manure for the enrichment of the exhausted soil. Another menace to soil with which the farmers are quite familiar is surface efflorescence of underground salts which make the soil saline and unsuitable for cultivation. Some people believe that the tube-well waters having considerable amount of salts dissolved, increase the surface efflorescence of salts. Such an opinion lacks observation and experimentation. This phenomenon prevails over considerable areas in the dry region of the United Provinces and other parts of India as well.

It has been observed that the condition of agriculture has been better and more secure with the advent of sub-soil water irrigation in the region under review. The State tube-well scheme has exercised a favourable influence upon rural economy and under such conditions any effort towards the improvement of the farmers will have a quick response from them, as they are now placed in a better position to embrace it. As every tube-well is provided with a transformer and other facilities, such as lighting, bathing pools, tanks for the cattle, Chaupals, trees to afford shelter, etc., it can be used as a focus from where to start the rural uplift movement for the welfare of the cultivators. There is also a possibility of the extension of tube-well irrigation in such areas where sub-soil water and cheap electric power are easily available and the rainfall is not regular and certain.

For the various problems which are of utmost importance and closely associated with the rural economy of the region, an inquiry committee is suggested to formulate a scheme to meet the various problems of Indian agriculture and carve out a programme for the rural reconstruction of not only this region but of all the provinces on a national scale.

In the end it will be apt to say that the 'Scheme' which has offered 'better living' to the dwellers in the United Provinces grid zone owes much to the untiring efforts and far-sightedness of Sir William Stampe whose proposals and schemes in spite of severe criticism and opposition are meeting success everywhere. His own words, given below, which have been taken from an article by him, amply show the scope and objects of the 'Scheme'.

"Perhaps I am an idealist, but I see in these activities more than the mere combination of overhead electricity with underground water, important as such a union is. I visualise in these measures the steady development of cottage industries on a wide scale, the gradual electrification of the farmyard and, with it all, that lowering of the cost of production which alone can really benefit both grower and consumer alike."

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The Problem of Desiccation of the Ghaggar Plain*

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In dealing with the problem of Desiccation of the Ghaggar Plain it is first necessary to define what is meant by the term 'desiccation' and to limit the area under consideration. For the purpose of this discussion, 'Desiccation' will be held to mean the deterioration of the country as regards water supply within historic times due to altered meteorological conditions or other causes thereby reducing its capacity to support human life.¹ On the basis of the above definition the areas affected in the Indo-Gangetic Divide are in the main confined to that section of the Ghaggar Plain which has an annual rainfall below 10". This area includes a greater portion of South-Eastern Punjab plains and Northern Bikaner and Bahawalpur sandy tracts.

The condition of this area is presented in two strongly contrasting pictures. The Ghaggar Plain has been in recent times an arid land with a comparatively sparse population. There are no surface rivers or streams in all this area except for the Ghaggar a monsoon river which rises in the Siwaliks and dries up before it enters the Bikaner Territory. Agriculture, the main occupation of the people, depends largely on the precarious rainfall of the area and is supplemented to a limited extent by the monsoon floods of the Ghaggar river and a number of State canals. The chief staple is Bajra (spiked millet)—a hardy cereal which on account of its drought-resisting qualities thrives well on these sandy soils. The natural vegetation is grass or drought-resisting shrubs which survive the prevailing arid conditions of the land.

In ancient times the Ghaggar Plain, on the contrary is represented by various lines of evidence as a fairly densely peopled country, well forested and with many populous towns which have either been replaced by small villages or are quite abandoned. In Vedic times (about 1200 B.C.) the Saraswati and its tributaries (which are insignificant torrents now) are referred to as huge

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streams flowing from the mountains into the sea.² The whole tract is believed to have had favourable conditions till so late as the beginning of the 14th Century.³

The historical evidence as to the desiccation of the Ghaggar Plain is, on the whole, meagre, varied and controversial. The conditions of life in this plain, which coincides with the area of the earliest settlement in India, are recorded in the *vedas*, the *Epics* and the *Sutras*. These communicate little information to us and mostly in the form of scattered incidental notices.⁴ The conditions in the mediaeval and pre-mediaeval periods are revealed by notes of Greek authors, the experiences of early travellers, accounts of contemporary historians and a number of autobiographies.⁵

Of considerable interest is the archaeological evidence. The whole country of Aryaverta (viz., the northern Ghaggar Plain), the Haryana (i.e. the middle Ghaggar Plain) and northern Bikaner is full of ancient ruins which tell the story of bygone ages. These relics make many writers to arrive at hasty conclusions as to the causes of their abandonment. Barnes writes "There is no denying the fact that the country in which the dry beds associated with the Hakra (lower Ghaggar) are at present situated, supported a dense population, as is attested by the ruins of considerable towns which are extant to the present day."⁶ "The existence of villages which undoubtedly must have been large towns—as is proved by the ruins in the neighbourhood of.....and the existence of forts such as Marot, Phulra, Mirgarh, and Derawar all lining the dry bed of the Hakra."⁷ "These ruins of towns and villages and the name of the arid area of Haryana (green) suggest that vast areas which were once fertile, are now arid wastes. A progressive desiccation of the *Punjab* has apparently been going on for centuries."⁸

Sir A. Stein⁹ investigated the question as to the cause or causes which led to the abandonment of the old sites of habitation in the Tarim Basin. He emphasized the necessity of realizing how varied the initial causes of abandonment may be in the case of individual sites before assuming *a priori*, be it only as a 'working hypothesis,' that the cause must in each case be connected with some phase of general or regional desiccation. Thus in the Ghaggar area, quite a variety of causes, entirely or partly, of human origin might lead to reduction in the size of settlements or even to the complete abandonment of larger cities. Prolonged periods of war or internal disorder, devastating epidemics, frequent famines and change of economic conditions are the causes which affect the distribution of population—causes and effects which can be illustrated from experience gained in historic periods.

The result of such diverse causes as indicated, may in each case be the same, viz., the abandonment of the once cultivated ground. On ground thus abandoned and subsequently left unclaimed, the settlement sites would go into ruins and would be preserved through the aridity of climate for longer periods. The same results would obviously be produced if the supply of water were from some purely natural causes to undergo serious diminution or altogether to fail. Thus the natural and human factors though quite different in character can produce results which may appear indistinguishable to those who after the lapse of centuries attempt to trace their causes in the light of purely archaeological evidence.

The archaeological finds at Hansi and the 'land of the Sarsuti' shows the existence of ancient civilizations in the valleys of rivers which have since then diminished in volume or dried up owing to certain causes which we shall examine later on, but they do in no way warrant the assumption that the general physical condition of the tract has considerably changed during the intervening period. The ruins of cities and forts along the dry bed of Hakra below Sirsa are mostly mediaeval and are actually situated in the dry bed of that river. They reflect the importance of sites surrounded by desert wastes which afforded security of life and property in those turbulent days and ensured some water supply due to the higher water table in the dry bed of the river.

However, these considerations—historical and archaeological, after being assigned their proper value, lead one to believe that the whole of the Ghaggar Plain has long suffered deterioration due to causes which have changed the condition of life in it to a considerable extent. What were the causes and how far do they explain the 'desiccation' of the area, are questions which are investigated in some detail in the following pages.

The common reaction when facing the problem of desiccation in many parts of the world—for instance in China,¹⁰ Palestine,¹¹ Tarim Basin¹² and South African Colonies¹³ seems to be to explain it by a change of climate—probably because it does, if once accepted as a hypothesis, give in a plausible form, a comprehensive 'proof' of the phenomena. It is significant, therefore, that in each of the instances mentioned above the hypothesis was destroyed by subsequent investigations based on more reliable data and scientific considerations.

It is no wonder therefore, that till 1874 A.D. the aridity of the Ghaggar Plain (particularly the lower plain) was attributed to a change in climatic conditions—the deterioration was considered a matter of course due to a gradual decrease in rainfall during historic

times.¹⁴ There were four main lines of argument. The records of the ancient population were claimed to prove numbers far larger than the existing water supply could maintain; the ruins of ancient towns, as mentioned before, were held to show that the country was more densely populated than would be possible under the present meteorological conditions; the land is represented as fairly well wooded, and the plain as reached by trade and other routes that have become impracticable owing to the desiccation of the region traversed. These arguments are further supported by the established existence of a former river (Hakra or Lower Ghaggar) which occupied the dry bed of Sotar and followed across the present Bikaner Territory into the Sutlej near its present junction with the Indus. It can, however, be assumed without any doubt that when this river flowed much of the Ghaggar Plain would certainly have had a better watered soil.

The question of diminution of rainfall in India as a whole was studied by Walker in 1910. He, on the basis of available Indian rainfall data, arrived at the following conclusions;

- (a) That the recent deficiency of monsoon rainfall in a large part of Central and N. W. India must be attributed to something abnormal in the larger movements of the atmosphere and not to human agency in India (i.e. irrigation and forest destruction),
- (b) The deficiency has not lasted long enough to justify the conclusion that there has been a permanent change of climate,
- (c) There are marked indications of a return to good seasons."¹⁵

Changes of Climate within the Ghaggar Region were examined in some detail later on, on the basis of meteorological and historical evidence¹⁶—though reliance had to be placed on the latter since records of rainfall in India are not available earlier than 1845 A.D. This enquiry indicates that there has been no material change of climate in historic times. If minor fluctuations on climate in historic times within the area be linked with larger variations in the rainfall in India as a whole, we may perhaps assume that there has been no significant change of climate and the explanation for the less favourable conditions during modern times is to be attributed to causes other than rainfall or climatic changes in general.

There is, however, one feature regarding the rainfall in these plains which tends to mislead common opinion and affects the conclusions arrived at by various authors who supported the change

of climate hypothesis.' It is the extreme variability of precipitation in the lower Ghaggar Plain—i.e. that portion of the plain which receives less than 15" of rainfall.¹⁷ The irregular alternation of good and bad periods of rainfall produce results which give an impression of a relatively permanent change.¹⁸

The majority of the writers from 1874 onwards, have explained the desiccation by 'theories' which, though differing in detail, have agreed on the principle that there have been important hydrographic changes in the present Indo-Gangetic Divide during the period under examination. The water channels in the Divide, their courses at different periods and the time when their water supply was either cut off or diminished are traced on the basis of historic evidence which is mostly ambiguous and sometimes misleading. The arguments lack due consideration of obvious topographic features of the watershed—a fact which can be explained by the absence of good survey maps which were only published during and after the Great War of 1914-18.

The first attempt to explain desiccation on these lines was made by C. F. Oldham in his 'Notes on the lost river of the Indian Desert'.¹⁹ He established on the basis of historical evidence that the dry bed of the present Ghaggar or Hakra was occupied by the Sutlej till as late as the 13th. century and that this has since shifted its bed westwards. This orientation of the problem on entirely new lines stimulated further research and a number of hypotheses were suggested on practically the same principle, locating the drainage lines of the Indo-Gangetic watershed by interpreting or misinterpreting the contemporary historical accounts of different periods.

Briefly speaking, the data from whence the arguments started were:

- (1) The existence of the ruins of forts and cities mostly along river courses—ancient and modern,
- (2) The dry beds of the Ghaggar, Naiwal and other streams in general and the Hakra in particular,
- (3) The accounts of travellers and contemporary records of invasions of India from the N. West, from Alexander's invasion upto the coming of the British,
- (4) The traditions, as recorded in indigenous literature, which have been considered by various authors as reliable.

Nos. (1) and (2) are 'rigid' facts in contradistinction to (3) and (4) which may be called 'Flexible'. The former cannot be

denied or disproved while the latter imply personal factors—of the writer who may exaggerate or minimise certain matters or suppress and distort relevant facts—and the person who interprets them. (Smith realised that even “contemporary evidence when it is available cannot be accepted without criticism.... The flattery of courtiers, the vanity of kings and many other clouds which obscure the absolute truth must be recognized.”⁴ Their extreme flexibility can be judged by the following conclusions arrived at, in solving the problem of the diminished water supply of the Divide.

That the present dry bed of the Hakra or lower Ghaggar was occupied during the historical times.

(1) by the river Jumna, which due to a general rise of level and filling its own bed, changed its course at some distant period towards the east,⁷

(2) by the river Sutlej which has gradually moved towards the west deserting a number of channels which are dry beds now,³

(3) by the rivers Jumna and the Sutlej both of which formed a common stream in the Hakra but later on both parted in different directions, one going towards east and the other towards west,²⁰

(4) by neither of these two rivers—and that the present drainage lines of the Ghaggar Plain have not, at least since 1000 A.D., changed to any appreciable extent. The absence of water in these channels is explained by the following facts: ‘The accumulation of sand in the area, which has been going on for centuries, does not let these torrents go a long way. The greater portion of the water is absorbed, and often the river disappears in sand, and reissues as a tiny stream some distance further away. It was probably due to this action that Chitang, which was a flowing stream during the Vedic period, is a dry stream now. It was dry in 1351 A.D. when its bed was used by Firozshah for his canal to Hissar. This action also suggests the reason why the classic Saraswati, which is described as a big river in the Vedas, does not even reach the town of Saraswati (Sirsa) which was built once on its banks, as its name shows. The drying up of the Hakra, which centuries ago was probably the main outlet of the Siwaliks in this area may also be due to the same causes’¹⁶.

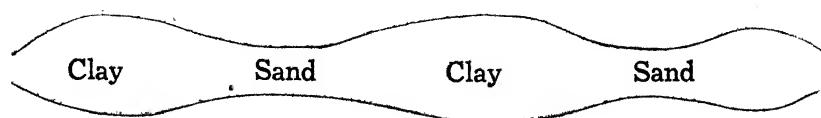
The force of the above argument is weakened in the light of recent researches on the changes of the water table in the Punjab as a whole.²¹ The nature of the substrata in the Divide can be studied in relation to the percolation losses from the canal troughs. The response of the sub-soil has always been, in a number of observations, in the form of reh-formation or water-logging—a calamity

which had started as a result of canalization by the middle of the 19th century. The absorption of the whole amount of moisture which flowed into the Hakra would have produced similar if not phenomenal results in earlier ages—of this there is no evidence.

It is not intended to discuss here in detail how the configuration of the country, the alignment of the Siwaliks and the narrowness of the present dry bed of the Hakra and the river terraces of the Sutlej²² preclude the possibility of this river (Ghaggar) being the main bed either of the Jumna or the Sutlej or both. Suffice it to say that the best approach to a purely physiographical problem as this is a close study, in conjunction with other evidences, of what is the true record of the layout of the country—the modern Survey Map.

Let us at this stage, try to answer a pregnant question; 'Was Hakra a perennial river in historic times ?'

An examination of the beds of the streams coming down the Siwaliks show one pronounced tendency. The streams, after their supply of water is stopped at the end of the monsoons, form hollows (or 'Lakes' so often reported in historical accounts) all along their beds. This process is helped by the fact that the soil of the Ghaggar Plain is predominantly loam with a tendency to become sandy towards western arid districts and clayey in the water-channels. The sub-soil is an alternation of clay and fluvial sand to great depths. These depressions or the 'lakes' hold water till it has evaporated in the dry season or is used up by the agricultural population of the adjoining area. They are filled up with rich alluvial clay by water action and result in the formation of clay patches all along its dry bed. The banks of the stream widen in the vicinity of the pools giving a somewhat irregular but recurring feature of the drainage line indicated schematically in the following figure:



In their later stages before they are finally dried up, these features become more pronounced or mutilated depending on the velocity and direction of the flow—which is of course intermittent and periodic. The Ghaggar, for instance, "before it reaches the Sotar, is confined to a comparatively narrow bed between steep banks, and during the rains sometimes reaches a depth of eight

or ten feet. Here and there its banks recede and leave a broad and shallow channel, or the stream overtops the banks and floods the neighbouring land....The river used to form three 'lakes' at Chanmal, Dhanaur and Rania....before the construction of a dam below Otu."²³

Besides, these periodic streams show a further development all along their course (leaving that portion which is nearest the hills). The water coming down the loose Tertiary slopes of the Siwaliks carries along a huge amount of detritus. Even in the rainy season river flow is not continuous and is in the form of intermittent spates following the fall of rain on the hills. These sudden differences in the flow velocity result in inconsistent bed and bank formations which contrast very markedly with those of the perennial rivers which abut the watershed on the east and the west. "The Sotal valley' for instance, 'is a well defined valley, varying in width from three to six miles, of no great depth and usually almost quite level from side to side but distinctly marked off from the light coloured loamy soil of the plain through which it passes by a clearly defined bank or sand-ridge on either side, and still more by its dark rich clay soil free from the admixture of sand'."²³

These tendencies of the Ghaggar in particular continue far beyond the Hissar boundary of the plain and show at least the intermittent nature of the stream flowing in it for some time.

If we believe in the fact that the Vedic name Saraswati means "rich in lakes"²⁴ and that this river as early as the Vedic times used to disappear in the sands,²⁵ we can assume provisionally that the river Ghaggar has been a non-perennial river at least during historic period.

If this assumption is true the problem becomes simpler. The sources of this non-perennial river must therefore lie in the Siwaliks —i.e. the foothills of the Himalayas the precipitation on the slopes of which feeds the Ghaggar and its tributaries during the rainy season. It is therefore obvious that no perennial stream like the Jumna or the Sutlej which are fed by the melting glaciers of the higher Himalayas, at the back of the Siwaliks, could contribute to this non-perennial river. The Siwaliks show no break from their Jumna end to that by the Sutlej through which even one perennial stream from the higher Himalayas could penetrate into the water shed. The whole Divide has therefore been watered by the Ghaggar and its tributaries—all coming down the Siwaliks.

On examining one inch scale maps of the Siwalik slopes²⁶ from the Sutlej to the Jumna we find at once a multitude of dry beds of torrents all over the area. The general character of these streams, near the hills is that of a broad sandy course, scarcely below the surface of the country and varying in width from a hundred yards to a mile, dry during the greater part of the year, but pouring down a formidable volume of water in the rainy season. They flow in shallow and ever shifting beds made of materials brought down by them. This character they maintain for a distance of 15 or 20 miles below the hills.

The above mentioned Maps show the gap in the Siwaliks through which the Jumna enters the plains. The western tributaries of this river are a number of torrents from the Siwaliks as for instance the Somb Nadi, Boli Nadi and two or three khols further eastwards. They all combine more or less near Chachhrauli and then crossing the Western Jumna Canal fall into the Jumna river seven miles further down. This distance of six or seven miles is absolutely flat and the stream tends to divert into the Western Jumna Canal so much so that an embankment about 10 feet high exists from the canal head to Mehr Mazra, a distance of 5½ miles.

The Western Jumna Canal was built originally by Ferozshah about the middle of the 14th century with its terminus at Sissar; but whether it derived its supply from the Jumna or the Chautang Nala, a stream further to the west and now merely a dry depression is uncertain....Advantage was taken, in fixing the alignment, of any natural hollow or channel where slope and direction was found suitable. Consequently the resulting work took the form of a linked series of drainages rather than of a canal.²⁷

The sequence of these facts therefore suggests that the main channel of the drainage of that portion of the hills which lies between the Somb Nadi and the Jumna was the present Western Jumna Canal which eventually joined with other streams of the Divide and formed a part of the Ghaggar system.

Let us turn to the Sutlej end of the Siwaliks, as shown in Survey of India maps.²⁶

"At Ruper, where the headworks of the Sirhind Canal lie, the Sutlej enters the plain. Three miles further down, the river enters a level marshy alluvial valley of soft material. In this trough the river has been accustomed from time immemorial to cut its channel at pleasure wandering freely from one side to the other.²⁸ The canal cuts through this difficult land and is traversed by the Budki

Superpassage. It carries across the canal two great torrents, the Sugh and Budki with a combined discharge of 60,000 cusecs. A little further down is the Siswan Superpassage which although not so large as the Budki proved the most difficult to construct."²⁹

It is difficult, however, to fix with accuracy the courses of these huge torrents during the past. What we can read from the maps is that both of them cut sharply across the old Sutlej bank at Bahrampur and it is with considerable river training that the torrents pass over the superpassage described above. The well defined cut across the old Sutlej bank and the existence of a dry bed parallel to the Sutlej culminating in the Naiwal of the Sirsa Plain suggest, though not with certainty, that these torrents might have been in the past a component of the Ghaggar system rather than of the Sutlej as they are now.

This behaviour of the Siwalik streams between the Sutlej and the Jumna i.e. their breaking up in three groups—one flowing to the Sutlej, the second to the Jumna and the third still supplying water to the Ghaggar during the rainy season, is supported by the fact that the level of the area is being raised throughout. The site of an ancient town excavated in Behut north of Saharanpur is 17 feet below the level of the present surface of the land. It is also possible that a change of level might have occurred as the Siwalik zone is still rising.⁸

Other subsidiary though direct factors which have been the causes of diverting and remodelling the drainage lines of the country are the alignment of roads and embankments thrown across the streams of the Divide. The direction of the routes (and therefore the main roads) in the Divide is, and has been since the early settlements on the banks of the Jumna, diagonally from North-West to South-East—a direction more or less at right angles to the Siwalik drainage. In South Africa¹ a similar alignment of roads and railways of the country not in harmony with the natural configuration has produced, within 100 years, results which have been mostly responsible for the desiccation of the country. The conditions in the Divide are similar, though magnified, since the history of the routes dates as far back as 1000 B.C. The resulting interference with the drainage lines can easily be visualised.

We can therefore, on the basis of physiographic evidence, which is in no way conclusive, state that in all probability the river Ghaggar was an independent non-perennial river, at least during historic times and that it received all the drainage of the Siwaliks between the Jumna and the Sutlej. The absence of water in the

Hakra or lower Ghaggar throughout the year may partly be due to the rather important fact that some of its tributaries were diverted by man or nature towards the two rivers bounding its plain on either side.

There is another aspect of the question which has been recognized both by the public and official opinion, namely the erosion of the soil and softer rocks of the country which has been proceeding on an enormous scale during the past. Prof. E. P. Stebbing³⁰ has examined the question of erosion in arid areas of Africa in some detail and although his paper is mainly concerned with that particular continent he makes frequent allusions to India, the Dust Bowls of the United States and Canada and the soil drift and 'deserts in the making' in South Australia. He finds on critical examination and observations covering different parts of the world that the diminution of the surface and subterranean water supplies and subsequent deterioration of the soil may be due to erosion in varying forms through the over-utilization of the soil, presence of neighbouring deserts and sand penetration or a combination of these two accompanied usually by dry or cold winds—factors which in short explain too well the decreased water supply and consequently the desiccation of the Indo-Gangetic Divide.

The evils of sheet and gully erosion on the Siwalik hills due to injudicious deforestation in the past have long been realized by the Indian Forest Department. 'The Indian Forester' a semi-official journal contains many interesting and instructive articles on erosion in different parts of the country. Of particular interest is the summary of a lecture delivered by W. W. M. Warren, Forest Research Officer, Bihar and Orissa at the Science College, Patna University, in which he exposes the effects of forests on erosion, floods, climate etc., giving illustrations from all parts of India.³¹ The mal-utilization of the forested slopes of the Siwaliks have resulted in frequent floods in the rainy season and little or no water supply during the rest of the year.³²—a set of conditions which differ considerably from those prevailing in earlier ages when the thickly forested catchment areas of the Ghaggar ensured a fairly even distribution of moisture over the Divide for the greater part of the year.

In the plains of the Divide soil erosion has been proceeding on account of over-cultivation and excessive pasturage—a fact much lamented by Gorrie in his paper read by him at the last session of the Punjab Engineering Congress.³³ He has analysed in detail these factors with reference to the U.S.A. in his book "Use and

Misuse of Land."³⁴ The top soil from repeated cultivation coupled with exposure to a hot sun and South-West hot winds disintegrates 'sur place' and assumes the form of dust which is blown away in clouds. It is probable from the modern examples³⁵ now in process of formation, that this is one of the methods, if not the principle one, by which the more level portions of some of the deserts of the Globe were brought into being, probably with the assistance of excessive pasturage by stock. With the dispersal of the top soil, increasing evaporation and drift of dry sand the area gradually assumes desert conditions.

Gorrie³³ deals with the Punjab in general and his remarks are based on observations in different stock raising areas of that Province. But the conditions in that arid fringe of the Rajputana desert which consists of parts of the Districts of Rohtak, Hissar and Ferozepore are the worst. A higher percentage of cattle per acre, coupled with lesser fertility and compactness of the soil has accelerated the rate of evaporation, deterioration of the soil and consequently the desiccation of the area.

On purely physiographical considerations, therefore, we can say in brief that the alleged desiccation of the Indo-Gangetic Divide during historic times is due to the decrease of the surface and subterranean water and not to any climatic change. The Ghaggar or Hakra has always been during that period the main drainage channel of the Divide. The diminution of water in this river has been due to :

(1) direct causes for instance

- a. the diversion of a few of its feeders to the Jumna or the Sutlej or both by natural or artificial causes,
- b. canalization and increasing cultivation in the area,

and (2) to indirect causes as

- a. deforestation and erosion in the hills in which lie the headwaters of the streams of the Divide,
- b. the erosion in the plains due to over-cultivation or excessive pasturage.

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Tuticorin—A Town Study

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Tuticorin, the largest town of the Tinnevelly district is situated at 8°-48' N and 78°-9' E. It is the chief port on the western shore of the Gulf of Mannar and forms a terminus of the South Indian Railway, 446 miles from Madras.

A Short History of the Town

The village of Tuticorin was inhabited by a class of fishermen called Paravans before the arrival of the Portuguese in 1532. It became a Portuguese settlement at about 1540 and many of the Paravans were converted to Christianity. In 1658 the place was captured by the Dutch who retained it till about 1782, when the English captured it from them. Afterwards it was passing between these two powers, more influenced by the results of battles between the two powers elsewhere. The place was finally ceded to the English in 1825, in whose possession it has remained ever since.

Physical Features

Originally Tuticorin was a small sandy village. It was nothing better than a low, marshy, undulating, sandy plain. It was a dreary waste, with sand dunes and swamps full of brackish water. The soil was, as it is now, sandy and swampy throughout. In parts the soil is so thin that no trees or plants will flourish; elsewhere there is little but heavy sand on which palmyra palms and a few bushes grow.

When the town began to grow the few natural water courses that existed previously were obstructed by roadways, buildings, and railway embankments and as a natural consequence water stagnated in low streets, hollows and low swamps, until it was absorbed gradually by the sandy soil. It was such impediments to the free flow of water and increased flow in the Puckle-Channel that drained the upland country in the interior that led to the floods of 1877 and 1884, when the local rains were abnormally high.

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The chief duty of the Municipality came to be the draining of the marshes and the filling up of the hollows, in order to ensure proper health for the residents of the town and to make available a greater area for its ever increasing population. In some places the sand hills were levelled;¹ in others the rubbish and sweepings were dumped on low swamps and were covered with sand then and there.² Thus places which once remained submerged under water for several months in the year were made fit for habitation and new streets were laid out.

Growth of the Town

The rise of Tuticorin to a position of importance was a matter of comparatively recent history. In the earliest years of the nineteenth century the sea-borne trade of the place amounted to a few hundreds of rupees in value, and compared with Kayalpatnam and Kulasekarapatnam—two ports near Tuticorin—this port was of no importance whatever. Even in 1835 the harbour was uncharted. It was after 1850 when the price of cotton rose (from Rs. 45 a bale to Rs. 60.) that new roads were laid connecting Tuticorin with the cotton areas and the export trade went up. The American Civil War (1861 to 1865) gave a fillip to its cotton export and the town naturally grew up by leaps and bounds. Thus cotton was chiefly responsible for the rapid development of the town in such a short space of time.

Tuticorin was one of the earliest towns to have the benefits of the Municipal system, which was introduced in it in 1866 according to the Town Improvement Act X of 1865. At first the Municipal town was comprised of a very small area and its western limit did not extend beyond Vattakinar, near which a toll-gate was located for a long time. Extension of the limits of the town was necessitated by increase in population. Melur³ was annexed in 1872. The railway line which was opened in 1876 brought to the port the export trade of the Southern Districts of the Presidency, and made it again necessary to extend the Municipal limits in 1877. Further extensions were made in 1906-07⁴ and 1930-31.⁵

1. A great swamp on the Cotton Road was raised and filled with clean sand with the aid of Government subsidy in 1914-1915.

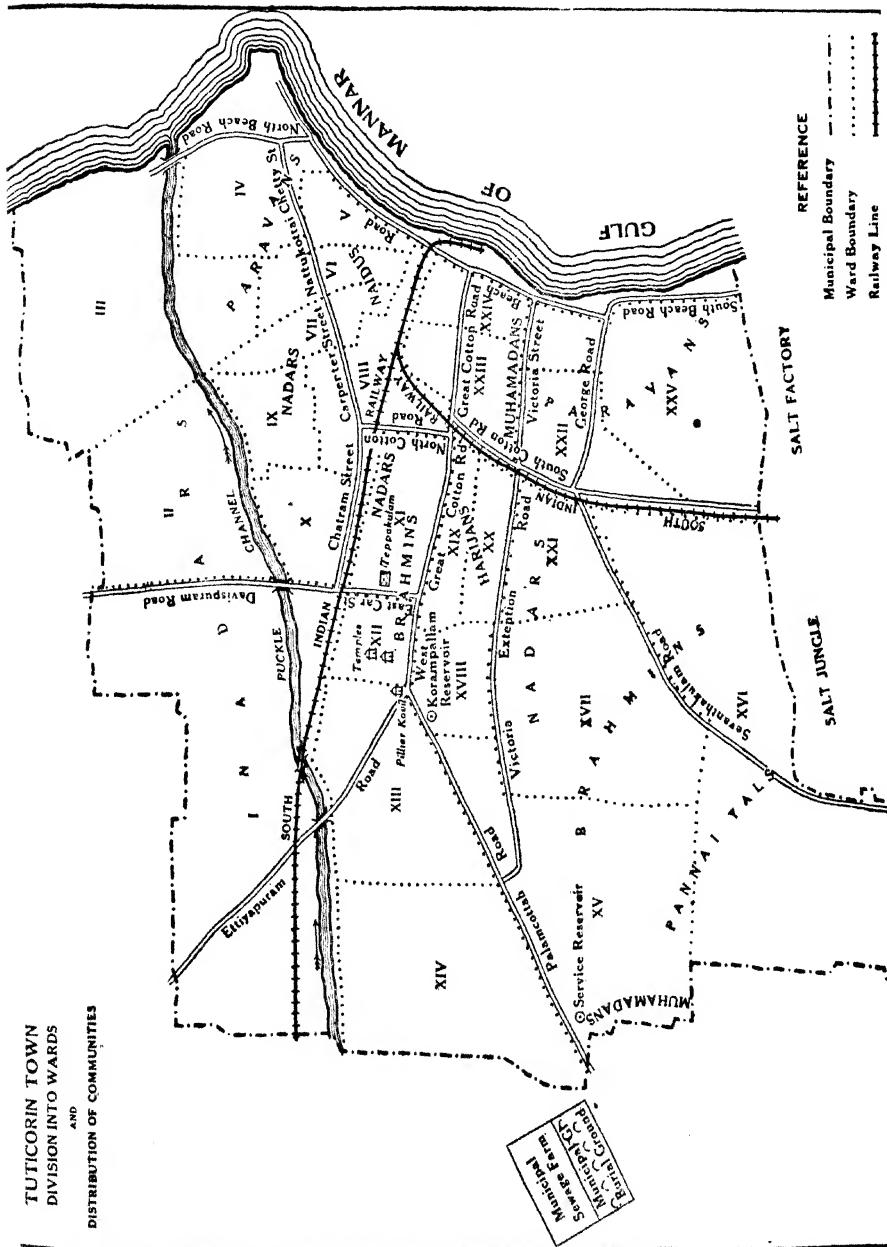
2. The site of the Municipal market in the Victoria Extension Road and that of the fish stall ground were once big swamps full of water for several months in the year and were reclaimed with street sweepings.

3. Melur is represented by wards 11, 12 and 13.

4. Sevendakulam was included within the town in 1906-1907.

5. The extensions are represented by wards 1, 2, 3, 14, 15 and 17.

**TUTICORIN TOWN
DIVISION INTO WARDS
AND
DISTRIBUTION OF COMMUNITIES**



Naidus are also in the services of the offices and industrial firms, more as mechanics and skilled workmen. Some of them earn their livelihood by carrying on some kind of handicraft. Many of them are not well off. They also live in the crowded parts of the city very near the place of their occupation; so they are found in wards 6 and 7 in the northern parts of the city in streets whose names are self-explanatory—Carpenter Street, Thattar Street, etc.

The depressed classes, the Harijans, live as coolies doing odd jobs, such as unskilled work in the construction of houses and roads, in the movement of goods to and from the boats and in the cleaning work of the Municipality. There is no need for them to live near the sea as in the case of the Paravans, for they know little of fishing, boating, diving, etc. They inhabit the area near the outskirts of the city in the West where the rent is very cheap and in the central part of the city wherever there is vacant land available to build their huts; that is, in wards 19, 20 and 8. In the latter case they are nearer the scene of their work where their services may be required at any time.

Some of the Mahomedans are traders while others are menials earning their precarious living by doing odd jobs. They are therefore found in the busy parts of the town between the Victoria Street and the Great Cotton Road in Karapettai, that is, in wards 23 and 24.

Nadars as a class are not confined to any one particular kind of occupation. About 40 per cent of them are Christians, chiefly Protestants. Many are engaged in trade and commerce mainly in the movement of goods between the port and the hinterland. A large number of them are skilled mechanical workers, either carrying on their profession independently as handi-crafts-men or finding work in industrial establishments. A few of them get into the learned professions. So they are distributed over a wide area in the central part of the city, that is, in wards 21, 11, 7, 11 and 9. Those who are engaged in drawing toddy from the palmyra palms live in the palmyra area in wards 1 and 2.

Lastly there is a labouring class called Pannaiyals (mostly Hindus) who find work in the salt factories. They naturally dwell in wards 15 and 16 near the salt pans.

Water-supply

‘Tutukkutti,’ the name of the place in Tamil, is said to mean ‘the place in which wells dry up.’ Hence the problem of water

supply is as old as the town itself. The swampy soil could not be expected to yield good drinking water, whilst the sandy portion of the town yielded but little drinking water. Moreover the water got from springs and wells was not wholesome.

A scheme to supply water from Korampallam Tank, five miles West of the town, was given effect to in 1872. This supply too was as precarious as ever, and failed for several months in the year, sometimes from January to October. Two other schemes tried in 1898-99 and 1908-1909 to supplement the supply of water were equally unsuccessful.

It was in 1913-1914 that the present scheme was decided. The source of supply is the portion of the Tambaraparani River between the villages of Vallanad and Morappanad, about 26 miles West of Tuticorin. The water is pumped to an elevated reservoir situated on a hillock, four miles away from head works, at about a height of 200 feet above the sea level. The water is taken from this reservoir to Tuticorin through a gravitation main which is 22 miles long. Still, a supply designed to serve the needs of 65,000 people cannot be adequate for the requirements of 80,000, the present population of the city. The pressure both in the public fountains⁹ and in the taps of the private house-connections is low. Sinking of more wells and installation of high power electric pumps are very necessary before the demand for water in the city can be adequately met.

Korampallam water and the connected works are maintained in good repair to supplement the main water supply. This water which is supplied to the dipping wells or cisterns is useful to the public for purposes of bathing and washing clothes.

Drainage

With a water supply of 1·2 million gallons per day it is very difficult to control stagnation and the consequent effect without a good system of drainage. The sandy soil, the presence of marshes and the low level of the town stand in the way of efficient drainage of the city. The construction of the railway embankment through the heart of the city complicated the problem of drainage. A few isolated drains which the Municipality constructed even in 1879

9. There are 132 public fountains in the city (1939-40). The total number of house connections at the end of the year was 2211, of which 94 were metred.

were rendered useless by the reclamation of the fore-shore and the occasional raising up of the level of the town. Hence the importance of a comprehensive scheme for the general drainage of the town based on the nature of the lie of the land came to be felt.

The disposal of the drainage too would be unsatisfactory in the absence of a general drainage system. For some time the sewage was dumped on various sand dunes, in and around the town. Later on it was emptied into the sea wherever possible, especially in the North and South of the town. But when residential quarters sprang up in those parts, the practice was abandoned and the dumping on sand dunes was resumed. In 1890 a small plot of land was used as a sewage farm.

The present arrangement consists in having open drains and cess-pools. A part of the sewage especially in the North of the town is let into the Puckle Channel. Another part is let into the sea through earthen drains and through a storm water channel. But as the channel is dry for most of the year, the sewage does not freely flow and the flow is even reversed during the high tides. Lastly sewage from cess pools is transported in carts to the sewage farms. The Tharuvai scheme¹⁰ consists in pumping sullage water on a plain which grows guinea grass, elephant grass, plantains, chillies and cholam. In another sewage farm maintained near the Palamcottah Road, the drainage water from cess pools is spread into plots where green vegetables like 'keerai' is grown.

It was the presence of horrible cess-pools and swampy areas that once existed in large numbers that drove many to such conclusions about the town as the following: 'A more insanitary and unhealthy town could never be thought of'; 'the town was a densely packed rookery between the swamps and the sea.'

The Director of public health has recommended canalising and screening of the sewage channels, systematic oiling of cess pools with oil-balls, and reclamation of low-lying lands. But all these can only be palliatives and temporary measures. The permanent solution lies in a systematic scheme of under-ground drainage.

Health

Formerly the public health of the town was quite unsatisfactory. The swamps in and around the town formed good breeding

10. It is in ward 2².

places for mosquitoes. Malaria was therefore a prevailing disease of the town. Scarcity of water for a good part of the year together with the absence of provisions for preventive measures led to periodical visitation of epidemics. The rate of mortality was dreadful in the early years of the Municipality and it gradually decreased as sanitary conditions improved. The present rate is considerably low¹¹ when compared with that of many other towns of the Presidency.

For the past 16 years there has been no epidemic of any kind. Thus the raising of the land lying in low level, formation of high-level roads, great attention to sanitation, watering of roads by means of water lorries and above all improvement in the water supply have wrought great changes in the general health of the town in recent years.

Absence of agricultural lands within easy reach caused no demand for either the street sweepings or night soil. Hence sweepings are utilised in filling up lowlands and swamps and for raising the level of the streets. The filth of the town is transported by means of a motor lorry for trenching it in a ground about half a mile from the town limits.

By adopting a number of preventive measures¹² the Municipality has been able to fight successfully against the incidence of epidemics. Still malaria exists in an endemic form as the mosquito nuisance is considerable. Cess pools, open drains, swamps adjoining the salt pans and the Puckle Channel are fertile breeding centres of mosquitoes. The only solution for this is the provision of systematic under-ground drainage.

Roads and Building Materials

Tuticorin is a sandy region in the vicinity of which no clay is available. Bricks cannot be made in the region; nor is it easy to get bricks from far-off places as the cost of transport of such a bulky commodity will make it very dear. But the Gulf of Mannar abounds in coral reef and so the availability of the coral stone so

11. The death rate is on an average 30 per mile.

12. The Municipality maintains a portable cinema equipment and two films—one on cholera and the other on hook-worm disease—with which it carries on an intensive health propaganda. The health staff consisting of a Health Officer, 6 Sanitary Inspectors, 3 Vaccinators, 4 Midwives, a veterinary Surgeon carry on an unceasing war against disease and ill-health.

near renders it very useful in the building trades. Again there are the Paravans who are habituated to the cutting of those stones and so the work is carried on without much difficulty at a small cost. The stone fresh from the water is soft and is not quite good; but exposure to the Sun and rain makes it hard and useful as a building material. In shaping the stones afterwards there is much debris that is left behind. Even this is not wasted as it is burnt to produce lime for the construction of buildings.

Being soft the coral stone is not quite good as a road material. There are quarries nearby which supply the town with material for the roads. Blue granite which is good for main roads is brought from Chinnanatham 7 and a half miles West of the town; quartz which can be used for other roads, is obtained in the village of Pudukottah, 9 and a half miles West of the town. The chief disadvantage is that these materials cannot be transported by rail.

Communication

There are two important through-roads, the last portions of which lie in this town. One is the Ettiyapuram Road which connects this town with Madura and Ramnad *via* Ettiyapuram. The other is the Palamcottah Road which connects this town with Tinnevelly, Nagarkoil and Trivandrum, *via* Srivaikundam and Palamkottah. They are the only road routes to connect this industrial and seaport town with the hinterland.

The railway line was opened in 1876 and this helped the town in the export trade of the Southern Districts of the Presidency.

The chief point about the railway line in the city itself is that it passes through the heart of the town and cuts all the North-South streets and roads. As there are no over-bridges in many places dislocation of traffic along these roads is caused. Facility for drainage is affected by the railway embankment. Such a position the railway line came to have, as it was laid at a time when the town had only ten thousand people; there was also the need to take the line to the landing and shipping wharves from which passengers and goods could be transhipped to the launches and lighters. There is a branch line to the salt-pans.

Along the shore is the beach road. As the town is also a port it is natural to find by the side of the beach road many of the companies engaged in foreign trade together with the port trust and customs offices.

Almost bisecting the town into the Northern and Southern halves is the Great Cotton Road, a mile long, leading from the Beach Road to the junction of the Ettiyapuram and Palamcottah Roads. It is the artery of the road-borne traffic of the town and its importance arises from its connection with the roads that lead to the hinterland. Its name tells us about the chief commodity that passes along it to the wharf from the up-country, that is, Cotton. As it is a busy road it has attracted shops to it and has become the bazaar street of the town.

Chief Industries and Occupations

There are 17 factories, 6 of which are seasonal in character. Most of them are related to cotton, the chief crop of the hinterland. A good portion of the ginning of cotton is done on a small scale in the cotton villages where the purity of cotton can be assured. Adulteration is the chief thing feared in towns; but large-scale ginning is to be carried on only in towns; cotton-pressing is not so simple as cotton-ginning as it involves much initial outlay in the form of steam-presses. Further, cotton has to be pressed before it is to be exported and so the need for presses is felt only at the port. Hence almost all the cotton presses in the district are concentrated within Tuticorin. The Madura Mills, situated on the Beach Road to facilitate the transport of imported coal, is the largest of the cotton mills of the district. It has nearly 700 thousand spindles and gives employment to 5,000 operatives.¹³

A number of Indian Companies and agencies of European firms that are engaged in the import and export of goods, port-trust and custom offices and a few banks that are engaged in financing trade give employment to a number of clerks and coolies. Hence the industrial concerns¹⁴ and movement of commodities engage a very large number of people of the town.

(a) Salt Manufacture.

A good number of people find employment in the salt factories which are found in the South of the town. The time of manufac-

13. The mill-hands live in the town itself as there are no well-developed suburbs in that sandy and swampy area. This is the main cause for the great density of population of the city. The ratio of men and women labourers is 3 to 1.

14. The number of workers in salt-pans, port fore-shore and railway is 2,000. A good number come from surrounding villages within a radius of 5 miles.

ture is naturally a rain-less period, that is, from February to September. The salt is produced by the solar evaporation of the sea brine. The sea water is let in by channels which run around the entire factory. The brine is first admitted into condensing beds; and after the water attains the required density it is let into troughs of well-rammed stiff clay where crystallisation takes place. The crystals are scraped out and taken to a platform where the heaps are left to dry. The factories are leased under the modified excise systems, by which the Government have reserved the right of buying salt not exceeding half the quantity manufactured by a licensee in a season. This right is exercised when the regulation of prices requires it.

(b) *Pearl Fishery.*

The shallow Gulf of Mannar is noted for its pearl fisheries. The pearl banks in the form of rocky out-crops of the sandy submarine plateau fringe the coast. These reefs are subject to certain disadvantages. They are exposed to the full force of the monsoons for a greater part of the year and this prevents the regular growth of the oyster. A mollusc known as suran spreads over the coral blocks and smothers the delicate young ones of the oyster. Lastly a mixture of sand and mud which forms the habitat of the chank proves detrimental to the growth of the pearl-oyster.

The Tulayiram Par, ten miles off Tuticorin, and Kudumutti Par, six miles from the mouth of the Tambaraparani have proved productive. The fishing which is the Government monopoly takes place occasionally, as the oysters generally take nearly four years to mature under ordinary conditions. Between 1801 and 1928 only 18 fisheries took place. From the latter date there has been no fishing till now. Generally pearl fishing takes place in spring (chiefly in the months of February and March) and at times in November and December. The Paravans take an important part in this fishing. The last four fisheries held in the years 1927 and 1928 brought the Government a gross revenue of Rs. 7 lakhs.

(c) *Chank Fishery.*

Another important commercial product of the Gulf of Mannar is the chank. The fishery is conducted from Tuticorin as a Government monopoly. The shells are found scattered in about 7 to 10 fathoms of water, buried in the sand on the sea-bottom. The fishery takes place almost every year between October and May. The diving is carried on by the Paravans who have acquired great skill

in this work. The large chanks are stored in a store house where the animal substance is removed by the process of putrefaction. The chank is cut into bracelets and worn by women in Tibet, Bengal and Assam. It is also valued as an ornament for the heads of bullocks and as a musical instrument for some of the Hindu ceremonies. The Tuticorin product is noted for its purity and the readiness with which the shells can be polished. The average annual output is 250 thousand.

(d) *Fishing.*

Tuticorin is the best market for fish on the East of the district. Hundreds of Paravans are engaged in this industry too. The valai is the commonest fish of all. There are also sardines, jew-fish, the Indian rock-cod, the seer, the sea bream and the red mullet. The boats used in this connection are generally crude dug-out canoes, improved by the addition of weather-board to each gunwale. At times when the surf is to be negotiated catamarans are pressed into service. The Tuticorin catch which amounts to Rs. half a lakh is made in the period between February and September.

Tuticorin as a Port.¹⁵

It is an important port serving almost all the districts of the southern part of the Presidency. Raw cotton makes up nearly half the total value of the export trade of the port, which conducts three-fourths of the trade of the Presidency in this article.

A reef begins two miles South of Tuticorin and extends almost 20 miles to the North. On this reef, facing Tuticorin, stand a number of islands, of which the Hare Island is important. Hence the water off Tuticorin is shallow and calm throughout the year. Only small craft can sail in this shallow water, while ships have to anchor 5 miles off the shore and unload into lighters only such goods as can be man-handled and landed at all. A boat-channel to a depth of 10 feet is maintained from the 2 fathom lines to the jetties. Attempts for the provision of a deep-water harbour have not been successful, mainly for want of sufficient finance. About 500 steamers and 600 coasting sailers call at this port. The annual value of the total trade taking place through this port was about

15. No details regarding the development and trade of the port are given in this paper, as they have been dealt with in full in another article under the title of *The Port of Tuticorin*, published in Vol. XV, No. 4 of this Journal.

Rs. 13 crores towards the end of the last decade and of this amount the export alone was of the value of Rupees 7·5 crores. But with the rising in importance of the modern port of Cochin on the West coast from 1927-28, more and more trade has been attracted to Cochin which has up-to-date facilities for the handling of goods; while Tuticorin with its time-honoured methods of loading and unloading has been gradually losing in importance. Thus Tuticorin, which till 1927-28 was the first among the minor ports of the Presidency and carried on about 15 per cent of the sea-borne trade of the Presidency has been reduced to the second place among the minor ports handling 10 per cent of the sea-borne trade of the Presidency.

Conclusion.

In spite of the falling of the trade of the port the town has registered a marked increase in population. The development of industrial concerns necessitating the housing of operatives within the precincts of the town together with the improved facilities in the water supply and sanitation has rendered such a change possible and enabled the city to grow more and more. Hence from being a densely packed rookery between the swamp and the sea Tuticorin has emerged out as a well-built town and port with broad streets, regular blocks of dwelling houses, public offices, factories and ware-houses.

Report of Summer School of Geography

(Held at Saidapet, April-May, 1941)

The Secretary of the Association has the honour to present the following Report of the Summer School of Geography, held at the Teachers' College, Saidapet from 7th April to 6th May 1941 :—

At its meeting held on November 2, 1940, the Executive Committee of the Association decided to hold a Summer School of Geography for a month from 7th April 1940, and authorised the Secretary to organise and conduct the course as in previous years. 22 persons joined the course (Appendix A), some of them coming from distant places such as Bombay, Trivandrum, Calicut, Rajahmundry etc.

The classes were formally opened by Prof. M. S. Sabhesan, President of the South Indian Teachers' Union at 10 A.M. on Monday the 7th April. The work of the Summer School went on steadily for a month at 5 to 6 hours a day; and the following scheme of work was gone through :—

- (a) *Pedagogy of Geography* : by Mr. N. Subrahmanyam.
- (b) *Elementary Surveying* : by Mr. K. Srinivasaraghavan;
- (c) *Map Work* : by Mr. N. Subrahmanyam;
- (d) *Mathematical Geography* : by Mr. S. Muthukrishna Ayyar;
- (e) *Diagrammatic Methods*: by Mr. S. Balakrishna Ayyar;
- (f) *Land Forms* : by Mr. V. D. Krishnaswami;
- (g) *Climate and Weather* : by Miss E. D. Birdseye;
- (h) *Oceanography* : by Mr. K. Ramamurti;
- (i) *Economic Geography* : by Mr. V. Tyagarajan; and
- (j) *Plant Geography* : by Mr. M. S. Sabhesan.

As part of the programme of the course a major week-end excursion (Appendix B) was conducted by bus for two days to Nagari, Poondi, etc., besides a half-day excursion to Pallavaram Hill.

On the after-noon of Tuesday the 6th May—the last day of the course, a tea party was held. Rao Bahadur C. M. Ramachandra Chettiar, B.A., B.L., F.R.G.S., Vice-President of the Association, then presented the certificates to the teachers who attended the

Summer School; and Mr. M. Subrahmanyam Ayyar delivered the valedictory address. The course then came to a close with vote of thanks.

The total collection of fees amounted to Rs. 285, out of which a sum of Rs. 140 was expended on conveyance charges of lecturers, clerical and other services and miscellaneous expenses, leaving a net balance of Rs. 145.

The thanks of the Association are due to the Lecturers for their honorary work in the Summer School as well as to the Director of Public Instruction, Madras and the Principal, Teachers' College, Saidapet, for allowing the classes to be held in the Geography Department of the Teachers' College.

APPENDIX A

List of Teachers who attended the Summer School of Geography in April-May, 1941.

1. *Mr. C. N. Alaganandan*, 74, Kodambakkam High Road, Madras.
2. *Mr. M. S. Chandrasekhar*, "Calamur House," Tondiarpet, Madras.
3. *Mr. R. Dorairajan*, B.A. Hons., 75, Guzili St., Trichinopoly.
4. *Mr. M. Gangaramayya*, B.A., B.Ed., Teacher, S.R. High School, Tuni.
5. *Mr. S. A. James*, B.A., L.T., Teacher, L.M. High School, Salem.
6. *Mr. R. John*, B.A., B.Ed., Teacher, U.L.C.M. High School, Peddapur.
7. *Mr. R. Krishnamurti*, B.A. Hons., 7, Muddurama Mudali St., Mylapore.
8. *Mr. D. R. Kale*, B.Sc., B.T., Lecturer, Suburban Educational Institute, Bombay.
9. *Mr. N. T. Krishnaswamy*, 3/24, Muthiah Mudali St., Teynampet, Madras.
10. *Mr. George Kurian*, B.A., L.T., Training School, G. C. Seminary, Tiruvella, Travancore.
11. *Mr. P. Manickam*, 143, Nainiappa Naick St., Park Town Madras.
12. *Mr. M. Narainswami*, B.A. L.T., Board Higher Elementary School, Katpadi.
13. *Mr. N. S. Natarajan*, M.A., L.T., Teacher, West Mambalam.
14. *Mr. N. M. Patel*, Teacher, Gujarat Vidyalaya, Calicut.
15. *Mr. T. K. Sambasivan*, 20/21, Ramaswami St., Mannady, G.T., Madras.

16. *Mr. T. S. Sankaran*, B.A., Teacher, Sir S. High School, Tirukkattupalle.
17. *Mrs. M. Seethammah*, B.A., "College View" Saidapet.
18. *Mr. N. Sivakumaran*, B.A., Semmangudi, Via Kodavasal, Tanjore District.
19. *Mr. S. Sivanandam*, Teacher, 6, Thayappa Mudali St., G.T., Madras.
20. *Mr. P. J. Sundara Rao*, B.A., B.Ed., Teacher, U.L.C.M. Training School, Rajahmundry.
21. *Mrs. P. Kanthamma Sundara Rao*, B.A., L.T., Schade Girls' High School, Rajahmundry.
22. *Mr. K. Venkatasubrahmanyam Rao*, 7, Saiva Muthia Mudali St., Madras.

APPENDIX B.

As part of the programme of the Summer School course, a week-end excursion was conducted by bus on 26th and 27th April 1941 to Conjeevaram, Nagari and Poondi.

Leaving the Teachers' College, Saidapet at 6 a.m., on Saturday the 26th April, the party first visited the shale-beds at Sriperumbudur, where a bank of shale formations of the Jurassic Age is exposed at a cutting made by a water-course. They next went to Walajabad on the Palar, where, after *chota*, the Hindu Religious School was seen in working, the Arts and Crafts Section drawing the special attention of the visitors.

The party next went to Conjeeveram whose town-planning was the special object of study. The temple of Ekambaranatha, one of the biggest in the locality was also visited.

After lunch at Arkonam, the party visited near Tiruttani a fine shady grove with pools of cool water even at hot dry season; and then continuing the journey they arrived in the evening at the Bugga temple near Nagari, where the night's halt was made.

The main geographic interest of the place centres round the springs that flow out from the side of the temple on the bank into the Nagari river, unceasingly even in the driest season. Next morning field study was made on the spot under the guidance of the staff, of the several points of geographical importance in the neighbourhood which was found to be a veritable laboratory for the purpose. The rocks and soils, the dyke formations which formed a special feature all over that region, the banks and bed of the river, the types of vegetation, the crops and settlements—all these afforded interesting and instructive food for direct study.



Shale formations *in situ*.



A boulder with a dyke.



Nagari Range, showing Syncline of Cuddappah Quarzites



Bugga (spring) pouring from the temple side into the Nagari river



Kailasanatha Kona (Cascade)

After *chota*, the party left for *Edaichi Malai*, passing through two or three weaving villages on the way. This hill chosen for the climb is 1,300 feet high. A perpendicular gneissic rock, with a loose piece on the top of it and another smaller one by its side, bears a rough resemblance to a person going with a headload, leading a child. A naive story goes on to narrate how a shepherdess going everyday to the hill top with a food basket on her head and leading her child by her side, had instructions not to look back, the disobedience of which one day converted them into a stone.

The hill top was utilised as an outlook tower for studying the country round, especially the valley of the Nagari river, which is running between two parallel ranges. The valley section with bare hills on either side, through dry crop and wet crop fields to the sandy bed of the river in the middle, formed an interesting pattern or formula in which geographic control over the landscape could be seen clearly and obviously. The white streak of sand along the river-bed bordered by the green ribbon of coconut and plantain gardens and rice flats afforded a pleasing prospect. The scattered settlements, linked together by the road running along the valley, formed another interesting aspect of study.

Returning to Nagari by about mid-day, and finishing lunch, the party started on their journey, passing through Puttur and Naranavam, and proceeded to visit Kailasanatha Kona—a fine perennial cascade on the northern side of the Nagari range, whose upper part was built of *Cuddappah* quartzite. The geologist of the party, Mr. V. D. Krishnawami explained how the supply of water in the driest season was kept up by the continuous flow from the trough of a long syncline, which ran from end to end of the range.

After bathing in the cascade and taking tea, the party resumed their journey and after a couple of hours' drive, partly across conglomerate region, reached Poondi, where a regulator is being constructed for improving the water-supply of Madras. The geography of the place has multiple interest—a double mound between which runs the Kortallaiyar in the bed of the old Palar, in some of the terraces of which artefacts and implements of palaeolithic man were discovered.

After a careful study of all the various aspects under the guidance of the staff, the party continued their journey and reached Madras by 8 a.m. on Sunday, the 27th April, after completing a tour of over 160 miles.

A couple of strenuous days with intense field study was felt by one and all to be a regular refresher course in itself.

Report of the Refresher Course in Geography

(Held at the Rishi Valley in May 1941)

Under the joint auspices of the 32nd Provincial Educational Conference and the 11th Geographical Conference, a Refresher Course in Geography was conducted for a fortnight from Monday the 12th May 1941 at the Rishi Valley (Chittoor District) for the benefit of teachers in secondary schools. A select, though not a large number, attended the course, one of the teachers coming from Bombay Presidency and another from Benares.

Mr. G. V. Subba Rao, M.A., Principal of the Rishi Valley School, formally opened the course at 9 a.m., on Monday the 12th May; and the work of the course went on steadily for two weeks at 5 to 6 hours a day. The following scheme of work was gone through :—

- (a) *Pedagogy of Geography* by Mr. N. Subrahmanyam ;
- (b) *Land Forms* by Mr. V. D. Krishnaswami;
- (c) *Climatology* by Mr. K. Ramamurti ;
- (d) *Oceanography* by Mr. K. Ramamurti;
- (e) *Diagrammatic Methods* by Mr. M. Subrahmaniam ;
- (f) *Map Work* by Mr. K. Ramamurti;
- (g) *Economic Geography* by Mr. V. Tyagarajan; and
- (h) *Elementary Surveying* by Mr. V. Tyagarajan.

The valley was found to be an ideal spot for field study; and the teachers were taken out almost every evening for direct study of land forms, rocks, soils, crops etc. As part of the programme of the course, a major excursion was conducted by bus to Gurramkonda, a hill fortress 18 miles off, which was used as an outlook tower for studying and interpreting the landscape round about from its top. Incidentally the nature of the country traversed—the terrain, vegetation, land utilisation etc., were also studied.

On the evening of Friday the 23rd May, the course was brought to a close with the distribution of certificates by Principal G. V. Subba Rao. Mr. M. Subrahmaniam Ayyar, who delivered the valedictory address, exhorted the teachers to build up the Home Geography of their own locality based upon true knowledge of the

place. He called on them to make meteorological observations to collect data, to record facts and to build up a geographical museum on both the physical and human sides worked out in sequence and correlation. Only so, he said, would modern geography fulfil its true mission of moulding the modern outlook and of vitalising and revitalising too, the educational efforts in the land.

The meeting came to a close with a vote of thanks proposed by Mr. B. Rajagopalan.

Proceedings of the Eleventh Geographical Conference of the Madras Geographical Association : Rishi Valley : May, 1941

The Eleventh Geographical Conference of the Madras Geographical Association was held in the Rishi Valley, Chittoor District from the 14th to 17th May 1941 under the Presidency of Sri M. Subrahmania Ayyar, B.A., B.L.

The opening session of the Conference commenced at 4-30 p.m. on Wednesday the 14th May 1941 under the spacious banyan tree before a large gathering of members and visitors. Mr. B. Rajagopalan, M.A., delivered the Welcome Address (Appendix) on behalf of the Reception Committee, after which Mr. M. Subrahmania Ayyar was formally installed in the presidential chair. He then delivered his Address, after which the meeting ended.

The second session began at 2-30 p.m. on Thursday the 15th May, when the following papers were read and discussed :—

(1) *Place Names of Chittoor Dt.* by Rao Bahadur C. M. R. Chettiar, B.A., B.L., F.R.G.S., and (2) *Public Health of Chittoor Dt., in relation to Environment* by Mr. P. G. Nityanandam Pillai, L.M. & S., L.P.H., B.S.Sc.

The third and concluding session of the Conference met at 2 p.m., on Saturday the 17th May, when the following papers were read and discussed:—

(1) *Early Man in Chittoor Dt.*, by Mr. V. D. Krishnaswami, M.A., Dip. Arch. (Cantab); (2) *Climate and Weather of Chittoor Dt.*, by Mr. K. Ramamurti, B.A., Hons., L.T., Dip. Geog.; (3) *Chittoor as a Tri-Lingual Junction* by Mr. V. Tyagarajan, M.A., L.T., Dip. Geog.

The remaining papers were then summarised for want of time and owing to the absence of their authors. In bringing the sessions to a close, the President observed that Geography provides unifying thought and lines of integration amidst variegated and ever-changing phenomena taking place on the surface of the globe. In view of the necessary and early specialisms, a generalising and comprehensive subject like Geography is a vital necessity in all educational systems. It is besides a window into the modern world; and

in the new world order that will be coming after the present war, it is bound to play an invaluable role.

The Conference came to a close with a vote of thanks proposed by the Secretary.

APPENDIX

Welcome Address

BY MR. B. RAJAGOPALAN, M.A.

With very great pleasure I extend to you a most hearty welcome to the Rishi Valley Sessions of the Geographical Conference. I welcome heartily the President of the Conference and Professor N. Subrahmanyam who has done so much for the cause of education in Geography in this Presidency. Year after year, associated with the Madras Provincial Educational Conference, has assembled the Conference,—the only Conference on a subject, of all the subjects which form the curriculum in our Schools and Colleges; and it speaks volumes for the enthusiasm, persevering drive and organising capacity of Prof. Subrahmanyam and his co-workers in the field.

I am not qualified to talk on Geography, or the improvement of the study of Geography, to the delegates who have gathered here, who are themselves keen students of the subjects, intent on improving its status and usefulness to the student world. I shall merely rest content with offering a mere layman's remark or two, feeling sure that the deliberations of the Conference will result in substantial gains to the teaching of Geography in the Province.

One hears frequently complaints as to the way in which Geography has been made the Cinderella of subjects in the School Curriculum, how its importance has been belittled by being yoked to its sister-subject, History, and what great improvements would be effected by making Geography independent, with separate marks in the S.S.L.C. Examination and longer time set for the paper. Surely now-a-days people know too much of examinations to be taken in by this specious argument. Whatever syllabus, whatever improvements, whatever systems the authorities in their cleverness might invent to make a disagreeable pill go down the throats of the invalid students, the latter would go a step further in cleverness and circumvent the trap laid by their teachers and the examining authorities. A four-anna book is bound to make its appearance

with fool-proof systems for window dressing and passing creditably. A fortnight before the examination, matter is bound to be mugged up and a creditable pass secured. What a great relief that cooking is not a subject for an examination and a degree!—as I am afraid presently our hostels and hotels and our domestic hearths even, would be taken possession of by Doctors, Masters and Bachelors of Cooking with first class cooking Diplomas and Degrees, to poison us with their delicate cooking and give us a perpetual tummy ache. Whatever we do let us not insist upon examinations, thinking of them as a good motive for the better study of a subject.

This year I had the great pleasure of learning from our S.S.L.C. candidates how the ship-building yards at Munich were resounding to the hammer-strokes of German workmen in their eagerness to catch up with the tonnage of the British Navy and Mercantile Marine. I learnt that Ellora was second only to Osaka in attracting millions of pilgrims from all over the world to have 'dharsan' of the relics of Buddha. I learnt much more and was happy that it was not only in history that it was reserved for me to learn that Sher Shah married Taj Mahal, that Alauddin levied scutage on Hindus and that Wycliffe, that Morning Star of the Reformation, lost his life on the gallows owing to the displeasure of the king because of his not favouring the divorce of Catherine of Aragon.

All these tit-bits are the result of our wonderful system of examinations for which unrelated facts have to be mugged up in order to secure marks. Is Geography studied because the students want to know how man lives on land, that land has got certain geological properties, that climate has its inexorable influence on land, and so the land can grow only certain types of vegetation and can support only certain species of animal kind, that man is to a considerable extent the creature of his surroundings, that man being endowed with intelligence tries to modify the harmful effects of his environment, and extend and promote the beneficial outcome of Nature's laws? In the helter-skelter of examinations, it is unreasonable to expect anyone to remember the purposes of Geography. If Geography is to teach us how Nature and Man act and re-act on each other, how both get changed by the work of one on the other, and how man can grow and has grown by attuning himself to Nature, then that is a lesson in religion, and the purposes of Geography being learnt, it will be learnt well with the purpose in view. But if Geography is to teach which parts of the world are red and which green, a Hitler or a Stalin undoes in a moment the geographical knowledge of adults, learnt through

painful years, and the students and teachers must start afresh right at the beginning.

History and Geography have to go together as both deal with human beings, the one with human groups in the past and the other with human groups at the present day. Many of the howlers in History would disappear with a better knowledge in Geography of the land as many of the howlers in Geography would disappear with a better knowledge of the History of the country and current events read in newspapers and magazines.

I have already encroached on the valuable time of your Conference and taken advantage of my position here to welcome you, to dabble in matters on which you, Ladies and Gentlemen, are surely better informed than I. I shall not any longer stand between you and your deliberations, except to repeat by hearty welcome to you all to Rishi Valley of which, I hope, you will carry with you to the places from which you come, happy memories of a good time spent.

Extracts from Periodicals

BURMA

A B.B.C. BROADCAST ON MARCH 3, 1941.

By

MR. L. S. AMERY.

"Geographically, Burma occupies the north-western and western part of that peninsula, French Indo-China occupying the north-eastern and eastern, while Thailand, which we used to call Siam, lies between the two in its southern half. In shape Burma resembles a kite some 870 miles from north to south and 575 miles from west to east with a long tail extending to another 500 miles southward. The western sides of the kite are formed by India and the Bay of Bengal; the eastern by China, French Indo-China and Thailand, while the tail runs down between Thailand and the Bay of Bengal almost to a narrow neck which separates Malaya from the main peninsula. Down the whole length almost of the kite from north to south runs the Irrawaddy, regularly navigated from Rangoon, the sea port capital, for nearly 900 miles by river up to Bhamo.

"North of Burma is a land of steep, lofty mountains and narrow valleys, all clad in dense forest. East of the Irrawaddy valley, the heart of Burma, lies the Shan plateau cut up by many mountain ranges and deep valleys. Here live the Shans, Kachins and other hill tribes who, though of the same branch of the human race, are distinct from the Burmans proper and are administered by their own chiefs in accordance with their traditional laws and customs.

"Burma everywhere is rich in natural beauty a verdant and smiling land. But amid all varieties of its scenery the Burmese landscape has one distinctive characteristic feature: the pointed spires of pagodas sheltering in each their image of Buddha and alongside them monasteries housing yellow-robed members of the Buddhist monastic order.

"In larger cities the pagodas are richly adorned—the spire of the great Shwe Dagon Pagoda, nearly as high as Saint Paul's, is completely covered with gold leaf, the tribute of devout Buddhists. In villages they are simpler, standing out in dazzling white against the bright green of the surrounding trees. But everywhere their

presence tells of religion which is an all-pervading influence in the life of Burma's 15,000,000 inhabitants.

Link in Air Route

"Strategically, Burma, tucked away in the north-east corner of the Bay of Bengal, plays no important part in the main sea routes which cross the Indian Ocean though she is a vital link to the Imperial air route from India to Singapore and Australia. Her main importance is landward. She is on the one side of the eastern bastion of India and on the other the northern outwork of Malaya with its all-important naval base of Singapore.

"The fact that she has a common land frontier with Thailand, French Indo-China and China, has its obvious bearing on the possibility of any untoward developments in that part of the world. Of these land frontiers the one that has figured most in the news of recent months is that with China owing to the development of that wonderful engineering enterprise known as the Burma Road though only about one-sixth of it lies in Burma.

"Cutting at right angles for hundreds of miles across range after range of mountains, the road has been the expression of China's unflinching determination to keep open for herself a door to the outside world. But now that hard pressure of necessity has once substituted a route available for modern mechanical transport for centuries old caravan routes which always maintained a trickle of trade between south-western China and Burma, we may hope that in happier times the channel thus opened may be yet further developed and bring increased prosperity to both the countries and not the least to Burma's great seaport of Rangoon.

* * * * *

Economic Aid

"On the economic and industrial side Burma's main contribution to common effort is as a supplier of certain essential primary commodities. She is the Empire's greatest producer of rice and India depends upon her not only for this staple food but also for oil and petrol. She is the world's main source of teak, the finest of shipbuilding timbers. She produces rubber, tin, lead and silver and more particularly is the chief Empire producer of wolfram or tungsten, an essential component of highspeed steel for machine tools. But she has neither iron nor coal and has therefore never developed heavy industries which would have been available for munitions production. She has, however, at Rangoon shipbuilding facilities and is turning out a number of small vessels as fast as she can.

—Indian Information, March 15, 1941.

GEOGRAPHY IN U. S. SCHOOLS**INCREASED INTEREST OWING TO WAR**

It has taken a war to awaken from a state of passivity the geography teachers of the elementary schools of the nation. After being battered into humble silence for a decade or more by their more flamboyant comrades, the social scientists, it is interesting to note, the rapid comeback of those who believe that the "earth is our home" and that we ought to know some of the fundamental facts concerning it, writes Mr. W. R. McConnell, Professor of Geography, Miami University, in *The New York Times*. As usual it was public interest that started the rebirth, for it seems that we are all now scouring available maps and atlases in search of African ports or Balkan valleys.

It should be clear to us that the political, social and economic relationships among the peoples of the world exist only because of the geographic features that make such relationships—or dependencies—necessary.

Basically, the tragic state that the world is in to-day is due to either a misunderstanding of or a maladjustment to physical features. As for the pedagogues, be they geography or history enthusiasts—or even "social scientists"—all must agree that here in America we owe our present leadership and potential future largely to our geographical position, physical features and our resources. The presence or lack of oil, the fertility of the soil, the harbours and shipping facilities, the amount of rainfall, the type of winter and the length of the growing season—each has its influence on what we do and how we do it.

To-day the newspapers of the country have their readers conversing fluently on the rainy season in Ethiopia, the mountain passes in Greece, the importance of island naval bases and the crops in the Ukraine. These are all geographic factors, and every day we become increasingly eager to learn more about them because we realize that they play an important role in our daily lives. Surely no one should try to belittle the efforts made by our schools to foster such intelligent understanding of the part geography plays in daily activities. It should be easier now to persuade the secondary schools and higher institutions that more courses should be offered in the economic, social and physical-political aspects of geography.

Prodded by the public, it behoves the teachers of geography to rise to the occasion and do their share in furthering the progress

of geographic knowledge. As a nation we are all too ignorant of the what, the where and the why of the lands of even our nearest neighbours. The active interest taken by our government in our good neighbours to the south offers a real incentive for a more intensive approach to the geography of Latin America. The average geography text to-day devotes but a half-a-dozen pages to the A B C countries, a few paragraphs to Bolivia, hardly more than a dozen lines to Peru and but passing mention of Venezuela.

PUPILS DEMAND INFORMATION

What is the relation of the oil fields of Venezuela to the defence of the Western Hemisphere? What bearing does the tin found in Bolivia and the rubber grown in Brazil have on our policy in South-eastern Asia? What relation have the vanadium mines of Peru to our effectiveness as an "arsenal for democracy"? How does the price of beef in the Argentine affect the lives of the people on our plains? What role do the miners in Chile play in the lives of the workers in the refineries in New Jersey? Surely a more tolerant and understanding citizenry would inevitably result from a deeper knowledge of such common problems as these.

The geography teachers have much to do and, sad to report, too few laurels rest on. When attacked *en masse* by a more vigorous group they retreated in haste, admitting to errors that were neither clearly defined nor righteously posed. Though guilty of minor infractions in the far past, such as the dull recitation of boundaries and the monotonous repetition of capes and bays, they leaped over themselves confessing imaginary crimes and have now had to be told by their eager pupils. "We want those facts, we can use those names, we can't come to conclusions without knowing the premises."

WHAT STUDENTS SHOULD KNOW

What then may we expect of children who have spent several years in the study of geography? We may expect an intelligent knowledge of such factors as continents, countries and bodies of water, topography and climate, longitude and latitude, distances and directions and resources and peoples. Further, we may expect children to have interests in maps and to be able to read maps intelligently.

Out of all these abilities come definite conclusions to guide them in the solution of problems, both personal and social, and

even international. They should find logic in the suitability of certain lands for certain crops; they should see justice in the innate rights of others to grow, to harvest and to market. They should look ahead to the future and help make provisions for the conservation of those things that need conserving. In fact, geography should help them to find not only how people make use of the land, the water and the air, but also how they can improve such use.

They should know the elemental whats, wheres and whys of the countries and of the people who inhabit them. Countries and people together make our earth a living, breathing, dynamic thing, a thing richly deserving our time and study. It is our garden and, as Voltaire said, "we must cultivate it."

MIDDLE SCHOOL GEOGRAPHIES

Middle School Geographies : By C. Raghunathan

REVISED EDITION 1941

According to the latest Syllabus

Book I for form I Tamil & Telugu each As. 10

„ II „ II „ „ As. 12

„ III „ III „ „ As. 12

**G. SRINIVASACHARI & SONS,
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News and Notes

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We are glad to acknowledge with thanks congratulations and offers and promises of support to the Journal in its altered title and widened scope. With increased circulation, we expect to be able to introduce new features in the Journal from the next volume.

* * * * *

It is understood that there is a move afoot for the preparation and publication in Calcutta of a National Atlas of India, the first of its kind in the country. The Atlas will represent natural conditions, natural resources and economic developments of the country, its history and pre-history as also the distribution, occupation and social conditions of the population. Dr. B. C. Law, President of the Calcutta Geographical Society, has consented to bear the cost of the publication, which will be on the lines of the *Atlas De France* and the *Atlas of American Agriculture*.

* * * * *

The Vice-Chancellor of the Dacca University has stated that it will not be possible to arrange to hold the next session of the Indian Science Congress at Dacca in January 1942, owing to communal tension in the locality. In response to the kind invitation of the Maharajah Saheb the next (29th) Session of the Congress will be held at Baroda instead.

* * * * *

The influence of Geography on the causes and course of the War has been frequently referred to in this Journal. An interesting reaction of it has been to make the average man in all countries more Geography-minded. An extract quoted elsewhere gives an account of how the American teachers have been roused by the War. In India, where several Universities and Colleges have not done their duty by Geography, the ordinary citizen looks to and learns his Geography from the newspaper!

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In a recent number we referred to the effect of the War on industrial production and the development of new industries in this country. We are happy to note that a ship-building yard has recently been inaugurated at Vizagapatam harbour by the Scindia

Steam Navigation Co., which with proper support, can be expected to form the basis of a national ship-building industry in the country.

* * * * *

The next session of the All-India Educational Conference will be held at Srinagar from 25th to 29th September, during the ensuing Dasara holidays. Teachers, especially of Geography, can avail themselves of this opportunity to visit this beauty spot and learn some first hand geography about the region.

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It is gratifying to learn that Queen Mary's College for Women, Madras, has provided for teaching Geography in the B.A. Degree course from the current year. The Degree Regulations, which have remained a dead letter in the Madras University Calendar for over a decade, will thus be availed of for the first time.

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We have, however, to note with regret that no provision has yet been made for the teaching of Geography even at the Intermediate stage in any of the Men's Colleges in the Province, even though Queen Mary's has been having it for over a dozen years.

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We welcome the salutary step taken by the S.S.L.C. Board, Madras, in response to our representation last year, of showing the marks in History and Geography separately in the registers of the candidates. It is now possible to allocate credit for good work done in either of the subjects and to penalise neglect. When responsibility can thus be fixed, the appointment of fully qualified and competent teachers of Geography to handle the subject will follow as a matter of course.

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But with the revival of the Matriculation Examination, which is expected to take place early enough, as part of the proposed reorganisation of Secondary Education in the Presidency, Geography can take its proper place as an independent subject on terms of equality with History, free from its present brand of inferiority.

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Even in the matter of the qualifications of the teacher of Geography, the authorities do not enforce the rules as strictly as on the teachers of other subjects; and anybody is thought good enough to handle Geography. Again, there is a wrong notion that L.T. or B.Ed. in Geography is by itself a sufficient qualification for

handling the subject, forgetting that the teacher learns thereby only the technique of teaching it, whereas it is only through undergoing a degree or diploma course that the teacher can gain a sound knowledge of the subject-matter. It is a combination of both that can be accepted as a full qualification for teaching Geography.

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The new syllabus in Geography for elementary schools issued by the Madras Educational Department will be welcomed as the first modern syllabus in the subject for the lower school to which Modern Geography is just filtering down in this shape. Ignorance of its aim and scope may lead to the wrong idea that it is heavy and impracticable. Hence, it is desirable that Refresher Courses are organised for the benefit of elementary school teachers, explaining the aim, scope and methods relating to the new syllabus.

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The Madras Geographical Association : The 15th Annual Meeting of the Association was held at the Meston Training College, Royapettah at 5 p.m., on Saturday the 22nd March 1941 under the Presidency of Mr. Syed Abdul Hameed, when the 15th Annual Report of the Association was discussed and passed, and the results of the elections were announced.

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After the Annual Meeting was over on the same day, Mr. V. D. Krishnaswami, M.A., Dip. Arch. (Cantab) delivered a lecture on *Early Man South of the Palar*.

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A Conference on the Teaching of (S.S.L.C., A group) Geography was held at the Meston Training College at 3-30 p.m. on Saturday, the 12th April 1941 under the Presidency of Rev. Percy C. Kerslake, when short papers on the following subjects were read and discussed :—

The Syllabus in Geography by Mr. N. Subrahmanyam;

Teaching of Climate „ Miss E. D. Birdseye;

Class Exercises in the use of Atlas

Maps „ Mr. B. Clutterbuck;

Use of Sketch Maps in Teaching

Geography „ Mr. K. Ramamurti;

Field Work in Geography „ Mr. S. Muthukrishna

Ayyar;

Class-room Handicaps in Teaching

Geography „ Mr. V. Tyagarajan;

Tests in Geography „ Mr. M. P. Rajagopal.

* * * * *

A Summer School of Geography was conducted at the Geography Department of the Teachers' College, Saidapet for a month from 7th April. Some of the teachers attending the course came from such distant places as Bombay, Trivandrum, Calicut and Rajahmundry. A Report of the working of the School is published elsewhere.

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Under the joint auspices of the 32nd Provincial Educational Conference and the 11th Geographical Conference, a Refresher Course in Geography was conducted at the Rishi Valley, Chittoor Dt., for a fortnight from 12th May 1941, a Report of which is also published elsewhere.

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The 11th Geographical Conference of the Association was held at the Rishi Valley from the 14th to 17th May, 1941, under the Presidency of Mr. M. Subrahmanya Ayyar, when papers on various aspects of the Geography of Chittoor Dt., were read and discussed. The Presidential Address and the papers will be published in the next two issues.

The next Provincial Conferences—Educational and Geographical—have been invited to the North Arcot District, and the venue will be Vellore.

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Reviews

The World : A General Regional Geography. By Jasper H. Stempbridge. (Oxford University Press) 1939.

This text-book of General Regional Geography of the World puts the right emphasis on human geography, describing how Man is conditioned by his environment and how he in his turn influences his environment. Part I deals with General Geography, i.e., Mathematical and Physical Geography, Major Natural Regions and Peoples of the World, and Maps. The remaining six parts deal with the regional geography of the continents, Europe being naturally treated in greater detail than the rest. The various European countries are treated as established immediately before the German invasion of Poland on September 1, 1939.

The volume is well illustrated with several maps and diagrams as well as with a large number of excellent pictures, typical of the various regions. Suggestive and stimulating exercises at the end of each chapter, an appendix giving an outline of the British Empire, a double page coloured map of the major natural regions of the world and an index of place-names are other useful features of this volume, which is suitable for use by pupils preparing for the school certificate and matriculation examinations.

North America. By E. G. Ashton. (George G. Harrap & Co., Ltd. London) 1939.

This volume of North America, which is one of Harrap's New Geographical Series, forms a suitable handbook for use by university students undergoing Degree or Diploma Course in Geography, being less voluminous than Russell Smith and Rodwell Jones. It presents the salient facts of the regional geography of the continent in proper correlation without entering into discussions. After a historical and racial account in an introductory chapter and a chapter on Structure, Climate and Natural Vegetation of the continent, the regions are treated in order from the Pacific to the Atlantic sea-board, including the Caribbean Lands. Several maps and diagrams illustrate the volume, which also contains a statistical appendix giving useful economic data, relating to population, crops, minerals etc.

The Bombay Karnataka : A Geographical Survey. By B. S. Seshgiri, Lingaraj College, Belgaum, 1941. Price Rs. 2.

Advanced Geographical studies are yet in their infancy in this country ; and "a student often knows the Geography of India as a whole, but he is hopelessly ignorant of the geography of his own province or area." "In recent times" says the author in his Preface to the book, increasing interest is being evinced by Indians to obtain geographical knowledge of this country, but unfortunately detailed geographical surveys of the different parts of India are still few in number. In some respects it is easy to compile a small book on a large country like India. On the other hand detailed accounts of smaller areas require intensive work." It is very truly so.

Cambridge Provincial Geographies of India have been the earliest attempts in this direction, though in some respects they have not been quite satisfactory; while Dr. M. B. Pithawalla of Karachi has been doing his bit by means of his researches about the Lower Indus Basin.

In a slightly different way Mr. Seshgiri has thrown light by this monograph on the geography of a cultural region on a linguistic basis, which from the physical point of view, however, is a composite area. The unit taken for study in this geographical survey includes the four Kannada districts of the Bombay Presidency, viz., Belgaum, Bijapur, Dharwar and North Kanara, and excludes the Kannada State of Mysore and the Kannada districts of South Kanara and Bellary of the Madras Presidency. Thus it cannot be said to be All-Kannada.

The treatment is sound, systematic and on right lines, properly correlated with physical factors, based on original sources and authorities, and with the appropriate modes of geographical expression and illustration. As is natural for an agricultural country, agriculture and crops have come in for special emphasis and fuller treatment. No glib statements are made; and the author has throughout based his arguments on statistics, which have been well used and presented in tables and appendices as well as worked up into dot maps where necessary. Several useful sketch maps and some typical pictures, a bibliography of references, and a glossary of Kannada, Marathi and English terms—are other useful features of this scholarly monograph.

Geology Applied to Civil and Military Engineering. By Prof. M. B. Pithawalla, Karachi. 1941.

This short article, published in the Journal of the N.E.D. College, Karachi for January 1941, is an advice to students of Engineering by a geologist and geographer on the importance of geology and geography in practical engineering such as irrigation, water-supply, dams, etc., which are coming to be of ever increasing importance in India as elsewhere.

The author deplores the lack of these studies in the Universities and the scant part they play at present in engineering curricula. He has usefully jotted his ideas under various geological aspects with which the civil and military engineers have to make themselves familiar. He cites Indian examples as to how lack of geological knowledge on the part of engineers has been the main cause of blunder in many a costly project. He pleads that it is time that engineers are made to recognise the value of essential geographical knowledge as part of their equipment and that the guardians of engineering curricula become alive to the real needs that the times demand.

V. D. K.

San Bernardino, California. By H. F. Raup. (University of California Press, Berkeley and Los Angeles, California).

This is a monograph, investigating in detail the settlement and growth of a pass-site (i.e., gap) city, which is one of the urban centres peripheral to the Los Angeles metropolitan area. Maps and plates amply illustrate the arguments of the brochure.

Select Contents from Periodicals

The Geographical Journal: December 1940.

Libyan Frontiers—By K. S. Sandford.

Fertility, Productivity, and Classification of Land in Britain—
By L. Dudley Stamp.

The Geographical Journal: February 1940.

Continental Slopes and Shelves—Prof. O. T. Jones.

The Spelling of Tibetan Place Names—By Lieut-Col. F. M.
Bailey.

Geography: March 1941.

World Outlook in the School—By C. C. Carter.

Trends in the Geographical Distribution of the Lancashire
Cotton Industry—By Wilfred Smith.

Albania—By M. E. Durham.

Thoughts on French Life—By H. J. Fleure.

The Journal of the Manchester Geographical Society: Vol. L.
(1939-40).

Meandering in Manchester—By Ethel Pickering.

Geographical Review: April 1941.

Laterite and its Structural Uses in Thailand and Cambodia—
By Robert L. Pendleton.

Books and National Defense: A Brief Survey of Some
Library Resources of Geographical Pertinence—By
Elizabeth T. Platt.

Anglo-French Rivalry in South-East Asia—By John L.
Christian.

Hinterland and Umland—By Eugene Van Cleef.

Asiatic Review: January 1941.

Burma's Mineral Resources and the War—By Sir Lewis Fermor.

Science and Culture: May 1941.

Ceylon and Northern India: A Geographical Contrast—
By D. N. Wadia.

Southern India Commerce: April 1941.

Economic Resources of the Madras Presidency III—Coconut.

Southern India Commerce: May 1941.

Economic Resources of the Madras Presidency IV—Sesame.

Human Affairs: June 1941.

Fatehpur Sikri—By Wahida Aziz.

Books and Journals Received

- The World: A General Geography.* By Josper H. Stemberige.
North America. By E. G. Ashton.
- The Bombay Karnataka: A Geographical Survey.* By B. S. Sheshgiri.
- Journal of Indian History:* December 1940 and April 1941.
- The Geographical Journal:* December 1940 January and February 1941.
- Annals of the Sri Venkateswara Oriental Institute:* December 1940
- Report of the Subordinate Officers of the Department of Agriculture, Madras for 1939-40.*
- The Visva-Bharathi Quarterly:* February-April, 1941.
- Indian Information:* March 15, April 1, June 1, 1941.
- South Indian Teacher:* April, May and June 1941.
- The Educational Review:* March and May 1941
- South India Commerce:* April and May 1941.
- Journal of the Manchester Geographical Society:* Vol. L. (1939-40).
- Kalaimagal:* April and May 1941.
- The Indian Journal of Political Science:* April-June 1941.
- The Indian Journal of Adult Education:* April 1941.
- The Indian Co-operative Review:* October-December 1940.
- The Geographical Review:* April 1941.
- Geography:* March 1941.
- Nagari Pracharini Patriki:* Vol. 45—Nos. 3 and 4.
- Adyar Library Bulletin: Brahma Vidya:* 8th May 1941.
- Geology applied to Engineering.* By Dr. M. B. Pithawalla.
- San Bernardino, California: Settlement and Growth of a Pass-Site City.* By H. F. Raup.

The Indian Geographical Journal

Formerly

THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

Vol. XVI

July—September, 1941

No. 3

Presidential Address of the 11th Geographical Conference

(HELD AT THE RISHI VALLEY, CHITTOOR DISTRICT)

By

M. SUERAMANIA IYER, B.A., B.L.,

Introduction

Friends.—Sixteen years have passed since the convening and inauguration of the Geographical Association at Madras by a band of earnest workers, who realised the value of Modern Geography in Modern Life and felt the want of an organisation for it and a platform of its own. To have been one of that earliest band, to have chared and chores and done many an other thing besides, so essential to the establishment of an Indian Institution in its infancy, to have been the first Editor of its Journal and served on the newly-formed Geography Board of Studies of Madras University—on such title it is that I have accepted the invitation and presumed to appear before you; and I request your indulgent hearing while I respectfully draw your attention to some of the Aspects of Modern Geography, especially Human Geography.

Section I.—Establishment of Modern Geography in the West and Madras

1. *Rennell* (Britisher in India).—Modern Geography is said to begin with Rennell (British), who has been justly claimed as the Father of Modern Geography. Using and applying *scientific methods and principles*, he described the Hydrography of Bengal and prepared maps therefor and an *Atlas of Indostan* (about

1790), publishing along with it a 'Notes' which contains valuable general remarks and testifies to the minute care he brought to his investigations.

2. *Humboldt, Ritter and Suess* (German).—Rennell's work lay unnoticed for long. Humboldt, the polymath, travelled in Central and South America in the 1840's and published his results in his work, 'The Cosmos'. There he elaborated the methods specifically known as 'Geographical Methods' referred to later (Sec. IV, para. 6). Ritter was Professor at a German University and developed by his teaching and mapping, Geography as a science. Suess was a geologist whose monumental work, 'The Face of the Earth' has been the foundation of all physiographical work ever since. Map-work went hand in hand.

3. *Reclus, Vidal de la Blache, and Martonne* (French).—A generation later, Reclus issued 'Universal Geography' which made Geography popular in France and England. Then came Vidal de la Blache and Martonne who between them established a School of Geography at the Sorbonne, whose works are classics in Geography.

4. *Mill, Mackinder, and Herbertson* (British).—In England, pioneer work was done by Mill and Mackinder. The appointment of Herbertson to the newly-created School of Geography at Oxford (about 1905) is the first outstanding recognition in Britain of the value of Modern Geography.

5. *Lyde and Fleure* (British), *Passarge* (German).—Professors Lyde, Fleure, and Passarge have carved each a niche for himself, by their fruitful generalisations and brilliance of their theories.

6. *Other workers*.—It is needless to say, Geography has come into its own in the British Isles and the excellent work organised by Professors and teachers there has radically altered the teaching, the text book and the equipment of the scholars, and the status of Modern Geography in addition.

7. *In India—Patrick Geddes*.—When Pandit Malaviyaji started Benares University, he invited opinions from savants, of whom Prof. Patrick Geddes was one. He made a strong plea for the inclusion of modern subjects like Modern Geography, which had taken strides on the Continent and made a stir in England. It fell flat there. Later, when he came to Madras (1914) to deliver lectures on Town-Planning, he made a powerful appeal for Modern Geography. It fell flat there also.

8. *In Madras, Slater.*—Later on, Dr. Slater was appointed Professor of Economics in 1917. He had in his book, ‘*The Making of England*’ (1910) advised the study of Geography to be taken up by those who had done the Exact Sciences, as the next step in the fruition of their sciences ; he had felt as Principal of Ruskin College, Oxford, the new ferment of Geography at work there. He tried to persuade the Madras Senate but in vain.

9. *In Madras, the Slater-Grieve Report.*—At last (1921) the Slater-Grieve Committee sat at it and in accordance with their Report, teaching of Geography was better provided for at the Teachers’ Colleges, and college-study of Geography was recommended.

10. *The Madras Geographical Association.*—Having personally come in contact with Prof. Geddes and Prof. Slater, I was eager to do my little bit ; and when Sir Ashutosh Mukherji, that greatest Educationist of his times in India, asked me, I submitted to him their views and mine on the importance and value of Modern Geography. But he was then engaged in those sharp duels with Lord Lytton, the Chancellor, which exploded finally in the famous Lytton-Mukherji Letters (1923). He could take no action. So, there too, it had to fall flat.

In 1926, Mr. N. Subrahmanyam succeeded Mr. Lakshmana Iyer, the Geography Lecturer at Saidapet. He had arrived at Modern Geography through Mr. Yates (1906), and as Geography-teacher at various centres had kept himself in touch with current thought and developments.

In 1926 we two put our heads together and planned an Association for Geography and met other two, Miss Gerrard and Mr. E. W. Green, who gave their hearty support to the proposal. Mr. H. Narayana Rao and Mr. S. Lakshmana Iyer joined us and later on Miss Birdseye.

At the first meeting convened, it was resolved to form the Madras Geographical Association ; and a very stimulating Address was given by Dr. Cousins at the Inaugural Meeting.

11. *Its Work.*—It is sixteen years since then ; and at this coming of age (by the Indian non-statutory reckoning) one may pass in review the work done so far.

12. *The Journal.*—From the start, the Journal has been published as a Quarterly and has been able to maintain its high level and promote research. Worthy of special mention are the series

of studies in Place Names and the District Geographies of South India and special monographs such as that on Iron and Steel in India. The Journal has received recognition in the World of Geography. It is taken by several Universities of America and Russia, is indexed in 'Geography' and 'Petermann,' and receives exchanges with high Geographical Journals. It is most gratifying to note that it has met with the approbation of great geographers of Britain, such as Profs. Fleure, Fawcett, Ogilvie and Stamp. At the instance of geographers in North India, the Journal assumes an All-India character and appears as 'The Indian Geographical Journal' from this year.

13. *The Meetings.*—Meetings are held periodically, at which lectures are arranged and discussions follow, on various geographical subjects, and they appear later on in the Journal. Special mention may be made of the meeting presided over by the Marquis of Linlithgow who has since become the Viceroy.

14. *The Provincial Geographical Conference.*—Under the auspices of the Association, an annual conference of those interested in Geography in South India is held in each District, in turn, where papers are read and discussed, bearing on the district in a sort of 'mass attack'. This Conference in Chittoor District is the eleventh of them ; and there have been such studies of eleven Districts accordingly.

15. *The Summer School.*—To spread the light of the new knowledge a Summer School is held every year, where an intensive course of training is given in the practical work and methods of teaching of Modern Geography. *Multum in parvo* is its motto ; and under the provision of a well-balanced course remarkable success has been achieved, thanks to the voluntary and continual services of Miss Birdseye and Messrs. Balakrishna Ayyar, V. D. Krishnaswamy and N. Subrahmanyam and others. It may be noted here that as a preliminary to opening Geography in the Mysore University, the Summer School was held at Bangalore, on the invitation of the Vice-Chancellor of that University.

16. *The Refresher Course.*—A shorter Refresher Course for the sake of teachers, especially in the mofussil, is given every year in the district where the Conference is held. It is highly valued by the teachers.

17. *Excursions.*—Geographical Tours and Excursions have been arranged and conducted in the several districts and also in

the environs of Madras. Almost all who joined them have been hearty in their praise.

18. *The University.*—For some years from the outset, the Association concentrated its attention on educating the educators, so as to dispel the ignorance about Modern Geography reigning in high places and overcome the prejudice against it. Before the Association began its work, Geography had been a compulsory subject at the Matriculation and an optional subject at the F.A. (the old name for Intermediate) under the name Physiography. By memorials and interviews and by persistent endeavours, the Association was at last successful. A separate Board of Studies was constituted ; Geography was continued as a compulsory subject in the Matriculation and recognised as one of the options in the Intermediate and the B.A. Modernised syllabuses were drawn up. A Diploma Course was instituted and run by the University with its own staff.

19. *The College.*—Under the enthusiasm generated by the Association, half a dozen colleges offered and made provision for Intermediate Geography, and more than a dozen others applied to the University for permission. By an unfortunate action, the students in all the Colleges but one were left in the lurch. The enthusiasm abated and the momentum was lost,—nor is it likely to revive for at least a generation to come. A burnt child dreads the fire : and Geography in Arts Colleges has remained a ‘calendar subject,’ a possible option but taught nowhere, with the single exception of the Women’s College of Queen Mary’s. There, Intermediate Geography has been taught since 1927 and B.A. Geography has just commenced (1941). Another Women’s College Sarah Tucker’s, Tinnevelly has been having it for Inter. Lately Mysore University is just beginning. Though endeavours have been frustrated in Madras University, the Association rejoices that most other North Indian Universities have wakened up. Aligarh and Calcutta have the Honours Course; Patna and the Punjab have the B.A. Pass course ; some others have it, and yet others have it under consideration.

20. *The School.*—It is a hundred years since Modern Education after western models began in our country. Ever since, Geography has been a School subject. Very good text-books on the old model were brought out by Rev. Symonds (of the Bishop Corrie’s) at the very inception ; by Henry Morris, later on; follow-

ed by George Duncan and J. B. Bilderbeck; and by the C. L. S. Manual, while Blanford's excellent work on India came out in the eighties of the last century. Up to 1911, Geography was compulsory for the Matriculation; then came the S. S. L. C. course which made it a non-examination subject. In the dire necessity our students labour under to concentrate upon marks, any non-examination subject naturally works on them like the proverbial last straw on the camel's back. So sank Geography into secondary place in Secondary Schools here and dwindled soon into insignificance. The Association from its very foundation addressed itself to remedying this sorry state of affairs. Thanks to the successive sympathetic Directors of Public Instruction and the Department of Education, Geography has been elevated into a compulsory subject without being a 'separate minimum' subject.

21. Ideals and Achievement.—We may now compare the work done by the Association with the objects it set itself at the outset. They are (a) to promote and diffuse geographical knowledge; (b) to secure for Geography its proper place in schools, Colleges and Universities; (c) to help to improve the methods of teaching Geography; (d) to work for a School of Geography being started; (e) to promote studies about South India from various standpoints.

The Madras Geographical Association can look back with legitimate pride on the work it has accomplished. Sixteen years, and every year crowded with activities and crowned with success!

It found Modern Geography nowhere in South India (or India for that matter) and has raised it here to its rightful place. It has successfully educated the educators and educated the people at large. It has been endeavouring to make the public cultivate 'a geographical mind' as Mr. Sabhesan put it and to 'geographise education' as Dr. Cousins suggested. Most gratifying of all, the work done by the Association has been hailed as unique in India and first-rate on its merits by veteran British Geographers. By its exertions it has earned for Madras the fame of being 'the cradle of Modern Geography in India.' And its example is spreading.

22. The Future.—Even if the Association ceases at this stage, it has fulfilled its mission. It has played an invaluable role in the shaping of geographical thought and teaching and in the reforming of Geographical Education in South India. Old prejudices die hard. Much yet remains to do. Work on similar lines has to be carried on; facilities for education in Geography through the

mother-tongue have to be brought about ; cheap maps and instructive pictures have to be arranged for; production of appropriate literature has to be stimulated ; the preparation of Home Geographies has to be undertaken; the care of Geography Teachers has to be taken in hand; etc.

23. *The Organisation.*—This narrative of the Madras Geographical Association makes one wonder how it was that the educational progress in so vital a subject as Modern Geography should have awaited and depended on the chance formation of the Association. Yet so it did. And the success is due to the subject having found an Organisation and the Man. By his devoted work, by his obstinate refusal to be side-tracked under personal bickerings, by his perseverent energy and persistence in season and out of season, by his indefatigable lecturing tours, besides the normal duties of his office, the Secretary, Mr. N. Subrahmanyam, has kept the objects steadily in view and has been fortunate in his colleagues who have accorded him their hearty co-operation.

24. *The Moral.*—My part has been like that of the wind in the dispersal of seed and my satisfaction is that the grain of seed has fallen on good ground and has grown up into the mustard tree shooting out 'great branches so that the fowls of the air may lodge under the shadow of it.' There are many other subjects that, like Modern Geography, are of vital importance to us, say Mechanics, and await similar labours for similar ends and similar success. And the story of the Geographical Association is told now in hopes that some such workers may be among you and find comfort and good cheer from that story. Obviously, it is not from any personal vain-glory that it is told here.

SECTION II

Development and Diffusion of Modern Geography in the West and Madras

1. *The Public of the West.*—The Public of the West take keen interest in their own and others' affairs. Six million copies of newspapers, for instance, are read at the breakfast tables of Britain which has a population only as big as South India, whereas the dailies here have not a lakh and a half circulation altogether. Geographical articles find their way into general as

well as special magazines. To read and understand them requires at least a working knowledge of Geography.

Besides, they are a much travelled people. Their travels and voyages have opened the world and are the bases of geographical knowledge (Witness from Hakluyt's *Voyages* down to the *Polar Expeditions*). Scientific curiosity has fitted out expeditions like the *Beagle* or the *Challenger*.

What great things of world-value have flowed from such travels! Sometime after his College, Curzon undertook a tour in Persia and Central Asia and his Sketches are as good as *Eothen*. In the Great War, while the Cabinet thought that Turks and Arabs were inseparable being together as Moslems and as Khilafaties, Curzon's travel-knowledge made him seek and find in Oxford, Lawrence, that Robert Clive of our times, and send him into Arabia and give the *coup de grace* at last to Turkey and to the Great War itself. I have already stated how Humboldt's travels laid the foundations of Modern Geography.

2. *Societies and Journals and Museums*.—The knowledge gathered is integrated at the Societies and published in their Journals. The Royal Geographical Society of England is the model to the World. At its proceedings, the attendance may be about twenty or less, but what illumination is thrown on the subject, say, Bolivia, by a consul, a prospector, a merchant, a holiday-maker and a scientist, who have all travelled thither! The Royal Scottish Geographical Society (founded by four persons) is widely supported; and as illustrative of its *wide range* of interest, you may note the article on the Punjab by Mr. Maclagan Gorrie. The 'Geography' of the English Geographical Association, Manchester, serves teachers more. The American Geographical Society and its Geographical Review (founded by W. M. Davis) are of the front rank; and others are produced *ad galore*. The Societies of France and Germany and their Journals are loaded with weighty learning. The Museums are of utmost help to Geography. Besides those of Britain there are such outstanding ones as the Natural History Museum in America, the Berlin Museum, the Science Museum at Munich, the Belgian Palace of Art.

3. *Universities, Schools and Colleges*.—Great is the debt of Modern Geography to the University. Under the functions of advancing knowledge and of consolidating and conserving it, there

is not a University abroad but has made due provision for Modern Geography, some more famous than others by the eminence of their Professors. Geography being a science and a dependent science, it is grateful to other sciences at the University. Provision is made for systematic study of Geography, at the College ; and for general knowledge in it, at the Schools.

4. *Books, Text-Books, etc.*—The *School-books* provide for learning by several stages and the improvement in them day by day is striking. All the mechanical aids to the understanding are there, by way of maps, pictures, and illustrations, and get-up, as well as language and treatment. For example, here is a book taken at random, Carter and Brentnall's *Man The World Over*, Vol. 3, Blackwell, Oxford 1941 (and in War times too). In its 252 pages of text there are 277 illustrations. The *Text-books* are an ordered summary of results ; and *Treatises* embody Higher Work along with the writer's own original work, e.g., Shott's *Der Indische Ozean*. As for other Sciences, so for Geography Germany has—The Primer, the Handbook, Journals and Year Book and Index. *Geographie Universelle* in serial volumes and Koeppen's Climate also in series are great Geographical Works.

5. *The School Geography Room.*—In well-appointed schools, the Geography Room is equipped with a full complement of modern appliances and Museum and Library as well as modernised teachers.

6. *Maps and Atlases.*—Maps are the *sine qua non* of Geography. Original studies in map-drawing are made in all Great Countries—even of the world as a whole, not merely by each, of its own. The map-work of Great Britain, of Germany, of France are well-known, and Russia has recently produced a highly prized set of sheets. For efficiency of school atlases, British atlases can now be compared with the German.

7. *Libraries.*— Even Public or Circulating Libraries stock, besides novels, books of travel and other books of general geographical interest.

8. *Popular Education.*—Popular Education is carried on through all the usual channels of the Press and the Platform, the Radio and the Picture House, and through special periodicals with articles brought down to the level of the man in the street from the lofty heights of the University, and Lectures given to them

with films, slides and opaque projection. The National Geographic Magazine (America) is an amazing production of Geography by pictures and coloured pictures, too.

9. *South India*.—The glimpses into what is being done in other countries, show what work lies ahead of us, in order to modernise our studies here. Unlike the case in England, there is little voluntary work and less private initiative. Government Departments, especially the scientific ones like Geology and the several other Surveys have a wealth of geographical matter but buried in blue books and inaccessible in general. The several departments themselves move in water-tight compartments and are superior to the non-official world.

There have been certain fortunate circumstances in South India. The Director of Public Instruction and the Education Department have complete control at levels below college levels and all but complete at college levels. And they are sympathetic to Modern Geography. But the difficulties come from within. Even so, under adverse conditions there has been a notable rise in the level of school-teaching, thanks to the Madras Geographical Association and its Secretary. Several schools are getting properly equipped. School books are improving. The examination is rationalised and neither cram nor crib is *necessary*. Education in the mother-tongue is being tried. And we have an excellent Museum and good Libraries.

But there is here no impulse to travel as among the Sindhis, Bengalees, or Chittagong Moslems ; no popular demand for knowledge of places, such as is there met by very cheap maps sold in Lahore (As. 3 each) or in Bombay (As. 6 each, varnished). The public interest is one of apathy and indifference. That of the educated is inertia of the past, ignorance of the present and prejudice of all time.

For another thing, these peeps into the work done abroad, should be impressive of the value attached to Modern Geography, by those progressive countries. They of the West say time is money and ask men to mind their business ; that they should esteem it so and take such pains over it must make one pause and think. The culture of many of us has not yet risen to the level of refraining from railing at things we do not understand in Literature, Science or Art. It is not therefore surprising to find sometimes men of high culture turn up their noses at Geography

having done that, they need know no more. Old prejudices die hard and new prejudices are caught fast.

SECTION III.

The Nature and Scope of Geography

1. *General.*—Geography has been sometimes called the 'Science of Man and his Environment.' It is spread in space but limited in Time, being in essence the knowledge of Here and Now. It embraces both the 'Sciences' and the 'Humanities,' partaking of the nature of each and using the methods of all, using over and above these the specially developed *methods of its own*. By virtue of its subject-matter, it opens 'windows into the world wonderful.' For these reasons it sustains its claim to provide true mental discipline and excellent culture.

2. *What is Geography?*—What is Geography, and what is Modern Geography, that it should be accorded a very high place in any scheme of liberal Education? This question is often on the lips of those even who have passed through School and College but have unfortunately 'by-passed' Geography.

3. *The Theme of Geography.*—Geography is primarily concerned with the surface phenomena of the Earth in relation to Man. Subjects, too, that are studied by methods specially developed by Geography fall within its purview, e.g., Botanical Geography and other adjectived Geographies.

4. *Place and Direction.*—Starting with the senses of Place and Direction, we find them manifest even in lowly life; witness the hiving bee or the homing pigeon; the tigress making her home with her cubs in the heart of a tropical jungle has a perfect knowledge of her terrain and environment such as may be envied by a great military commander. In Man, the knowledge rests not upon instinct but reason; the environment is ever-spreading deep and wide, so as to reach to the uttermost corners of the globe. Such knowledge has been accumulating all along and ever improving, being handed down from generation to generation. Each age has to systematise and classify the knowledge it has received and preserve it in assimilable form, enriching it with its own additions and corrections.

5. (1) *Locality and Neighbourhood*.—Keen knowledge of Locality and Neighbourhood is exhibited by primitive communities, too, whatever be the extents of the one and the other. And from ancient times, Geography has always formed an integral part of Education in every course of instruction. We see it in the *Cyropaedia* or the *Buddhacharita*. In the *Ramayana*, for instance, Prince Rama is wrested by Viswamitra from the hands of his unwilling father, lest he should grow into a petted and spoilt child, a booby of the palace. In the Sage's education of the future monarch, Geography is taught at first hand, the Prince being conducted along mountains and rivers, through forests and hermitages, and in among the several inhabitants, and told the legendary lore also appertaining to the places and men.

5. (2) *Truth in Legend*.—Legends, by the way, enshrine often a geographical truth, embellished with mythical explanation. The fact is a fact, for all that. The legend serves to attract people's attention and preserve the wonder of it for all time. That huge rock-column jutting from the hill-top, Yadachi Malai of this (Chittoor) District, is a striking example of sub-aerial erosion. The scientific explanation is a recent thing, the science itself being recent. But, for long, people have been drawn to this piece of geographical wonder, under a legend which fancifully makes it the metamorphosis of a shepherdess with a basket of dairy product on her head who, out of feminine curiosity, looked back when forbidden to do so. Reduce it to a cold fact in a dry text-book and look at it so, and you miss the charm and wonder of nature.

5. (3) *Importance of Locality and Neighbourhood*.—Locality and Neighbourhood are the first themes of Geography, they are of the first importance to every man. Very instructive in this connexion is the rebuke administered by Aurangazeb to the old Mulle Saeb, the tutor of his boyhood, who, on hearing of his accession to the throne sought the Royal Presence in hopes of rich rewards. He was born in the purple, the Emperor said, and by the family law of Timur House had either to wade his way to the throne, sword in hand, or perish. It was necessary, he said, that he should have been taught of the lands and peoples, of the wealth and might and resources of his own realm and of all the neighbour-kingdoms, and of the great kingdoms of the earth. In the tender years of boyhood, the mind is most receptive and takes on impressions best. Those precious years were in his case, he com-

plained, simply run to waste over the bare mastery of Arabic. Why was he denied, he asked, such vital knowledge, and given instead only hard grind in Arabic grammar ; could not the bread of knowledge be brought home through the mother-tongue ? Dismissed with such words, the old teacher repaired home a sadder if not a wiser man.

As you may remember, it is upon very similar points, Socrates rallies the twenty-year old Glaucon, that would-be leader of his State, who, with the presumption of youth sought that honour without a modicum of knowledge on such fundamental matters. To one and all, such knowledge is now vouchsafed by Geography. Under democracy, we are each a ruler though but to a 1,380 millionth part and have duties, in addition, as a full subject. If we also substitute English for Arabic and remember what burning issues Aurangazeb's questions are in Madras even to this day, we can see how in these matters the Great Mogul was far in advance of his times (which was almost three hundred years ago).

6. (1) *The Knowledge, Essential, Generally*.—We must know of our Neighbours, there is no choice given us. Who is my Neighbour, is the question posed by the man of law to Jesus who in reply gave the Parable of the Good Samaritan. Upon the moral duty of neighbourliness rests His answer which singles out the Samaritan as the true Neighbour, him who poured the oil, bound the wounds and gave two pence for the sake of the wounded man on the wayside when others, the high caste Levite and the priest, had passed him by on the other side. To the same order of ethical thinking in neighbourliness belong the great maxims, 'A great soul looks upon the whole world as one family' *Vasudhaiva kutumbakam* (*The Panchatantra*) ; 'The nobler the soul, the larger the objects of compassion it hath.'—(Bacon).

Our hard work-a-day world demands, however, a realistic matter-of-fact solution, be the neighbour good or bad. Geography furnishes the answer, looking at things objectively, dispassionately.

6. (2) *Neighbour by Conquest of the British Rulers*.—On the political side, also, the several parts of the world are brought closer and closer together. Every great war of modern times has concluded in Britain's greater and greater accession of World-Power and the present war is destined to make Britain

Moslems only, admire the beauty of Taj Mahal, as a masterpiece of human Art, *in general*, dropping the peculiarities of the actual Builder-Emperor. The type of man, from the view-point of Geography is that of Goethe's Nobleman, a favourite poem with Lord Morley, in which there are such pieces as this—' Man alone can do the impossible ; he watches, judges, chooses ; and by following Nature, surpasses Nature,' as he has since done in the air, for example.

12. *Its Practicality.*—Also, Geography is very practical. It treats of things as they are and have been and may be ; marches on all fours with reality, constantly adjusting and readjusting itself thereto. It handles facts and figures in the concrete and there-through passing to the root-causes of phenomena explains the past and forecasts the future without relaxing its grip on the present. Being practical, it affords to that extent a valuable corrective and discipline to studies that are purely academic.

13. *Its Synthetic Character.*—Another peculiarity of Geography is its synthetic character. It draws its data from other 'sciences' and 'humanities,' and with them constructs its edifice. Its primary concern is not with the making of the brick and mortar but with making the brick and mortar into the great building, taking them from others. A whole view is presented thereby. The six blind men in the story describe the elephant by parts but a normal man sees it as a whole ; the geographer sees further: the habitat, and the uses man puts it to, in Peace and War.

14. *Its admitting of academical treatment.*—At the same time, Geography lends itself to academical treatment capitally. Geography provides sumptuous food for thought and rigorous mental discipline of exact and exacting orders. In observations on the field and in the study, in the collection and selection and classification of data, in the discovery of general laws underlying phenomena, in the building-up of theories as abstruse as may be, in the exposition or extension of results, Geography provides as good a scope for study at the University as any other subject of the 'Sciences' or 'Humanities.' Doctorates are conferred in England for work done in Geography and English Universities, especially London, are the model to us in Madras.

Some there are, it is true, who are of opinion that for a subject to be academical it should be caviare to the general, be mystical and be remote from the practical side of life. Any Professor who

thinks so can make it so, easily ; for such treatment—in Geography, too, there is scope.

15. *Its value as an educational subject.*—As school or college 'subject', Geography stands second to none. It feeds the growing mind of the youth with real knowledge of things about him ; and *under right guidance* can exercise and strengthen it in all its faculties. It helps him the better to understand the world in which he is to take his place and play his part. Although knowledge is but one in texture and composition, the mass and complexity of knowledge at the present day compel specialisation and study in parts. To all such specialising, under names such as Physics etc., Geography makes a large portal of entry; affords a corrective to narrowness ; and is complementary, by tracing and working out the consequences of their results to Man. To give examples. The geologist sees an ore and marks its distribution ; the chemist analyses and assays it ; the economist studies the conditions and trends of prices ; the Geographer notes them all and studies also the results and effects upon life and occupation. The palaeontologist discovers the prototype of the plantain ; the botanist studies its physiology; the economist finds the laws of its supply and demand; the Geographer maps its distribution on earth, notes the conditions obtaining there, the several uses to which it is and may be put, its value as food and cash crop to man, and its influence upon the peoples' lives at large.

16. *As an Examination 'subject'.*—As an examination subject, Geography can be made as good as any other subject—or quite as bad. Its very generality and comprehensiveness easily lend themselves to faking and cram, which some consider as the only royal road to success in marks and (thereby) in life. In South India, as a general rule, no subject is studied unless it is made an examination subject ; and there is no examination subject but is susceptible to cram. That is rather unfortunate. The true remedy, however, lies with the examiner and the teacher. Dr. Dudley Stamp once said that in a Geography paper, he set the question, 'Discuss the Population Problem of Japan.' One candidate answered, 'I do not know if there is any such Problem in Japan, but if there be, such and such consequences would result,' exhibiting a full grasp of fundamental geography and Japanese conditions. And the Doctor added that he gave full marks for it. That is an outstanding example. Or take this from Lyde's Textbook of Geography, 'Describe the results if the Peninsula instead of spread-

ing South from the Himalayas, had spread North'. The question demands a competent grasp of the Geography. It is only such a firm grasp that is of value in catching the geological horizons at different epochs.

Section IV.

Modern Geography.

1. *The Old and the New.*—Between the Old-time Geography and the New, the difference is mainly one of outlook and method. It lies also in the inclusion of fresh data made available by the Sciences on which it depends, by the progress of geographical Discoveries, and by the results obtained through the application of the special methods of Geography.

2. *The Descriptive Gazetteer.*—The old text-book contented itself with a descriptive gazetteer of the countries treated, busy with Place and Name. That element there must remain always: we cannot place the Nile in Sind nor the Indus in Egypt. But the emphasis has been shifted from the bare fact of location to the causes and effects of location—from the Where to the How and the Why and the Wherefore.

3. *Correlations and Sequence.*—We note the sequence of things and observe the correlations—in Egypt, for example, the climate, the rainfall, the floods, the fertilised parts and the desert; the cotton, wheat and lentils; the lives and occupations of the Fellaheens, the Copts, the Arabs and the British and the International swarm. The discrete facts reveal an underlying organic unity, leaving of course, on the margin, several irreducible anomalies present in so complex a life as that of a civilised people. We arrive at last at a more satisfying and harmonious picture than before.

4. *Locational Comparison.*—The determinism of Science applies here also: 'Like causes, like effects.' To carry the example above given a step further. Let us suppose we have studied Egypt and Sind separately; certain common features force themselves on our notice—perennial rivers making Egypt the Gift of the Nile and Sind, of the Indus; the floods making soil and spreading fertility; the climate and the desert; the potentialities of cotton, in Sind. We observe the causes and effects that underlie this apparent analogy and note the differences as well.

5. *Creative Power*.—In fact, the planting of long-staple Egyptian cotton seed in Sind marks another step in the making of the country by man. The Sukkur Dam and the long-staple cotton are the direct outcome of geographical comparison between Egypt and Sind. The geographical knowledge of man has thereby attained to creative power. For another example, take rubber. Discovered at first as the latex of certain Hevea trees, native in the Equatorial forests of the Amazon, the rubber tree has been sought and found in other equatorial forests as of the Congo and the Dutch East Indies. What is more, the seed was taken from the Amazon tree to Kew Gardens, London, where, under hot-house, it was grown to a seedling. The young shoots were then transplanted in Singapore and Malaya, after first failures, successfully. The plantation rubber has since spread to wherever in the tropics there are favourable conditions of sun and rain and soil and cheap labour is made available. It is to-day of such importance as to make Great Powers compete with one another for such lands, with swords drawn.

6. 1. *Geographical Methods*.—Three distinctive methods were elaborated by Geography in the last century and are associated with location on Earth.

6. 2. *The Extension Principle—Maps*.—The principle of Extension locates the several places on Earth and draws them on Maps, where the same things or phenomena are found distributed. The study of such Distribution Maps yields valuable results apart from the visual aids the maps are to the mind, to grasp their occurrence. A classical example is the map of volcanoes showing their large distribution on either side of the Pacific. The distribution map has so soaked into the public mind that there are few official or other publications that do not display such maps.

6. 3. *Locational Comparison*.—When the same phenomena occur at several places, Locational Comparison often takes us to the true causations that may underlie them. From a close study of earthquakes wherever they occurred and of the buildings that stood or fell to the shock, the Japanese scientists (for whom Dr. Milne invented the Seismograph) have been able to design *types of substantial buildings* that can be quite *quake-proof*. So states the late William Davis in the Geographical Review of New York. Without such study the place would be abandoned as accursed and malign or only flimsy buildings would be put up. Similarly by locational comparison the Kalahari and the Atacama deserts have

been traced to the planetary movement of winds as the cause of their being deserts.

6. 4. *Locational Causality*.—The principle of Locational Causality is the same principle as in other sciences but with the locality remaining as the chief causation. Examples abound.

7. *The American Geologists : Stage, Horizon and Work*.—The American Geologists have familiarised us with the concepts of Stage, Horizon and Work. The Stage is the state of the thing studied, at a given epoch ; the Horizon is its environmental setting at that epoch; Work is the natural processes that are in operation thenceforward. These have simplified our concepts in Physical Geography.

8. *Fundamental Causations*.—Lyell's Principle—that the fundamental causes at work in the Earth in the present are those that were so in the past and will be so in the future—profoundly changed previous geological theories and are now axiomatic and widely applied in the study of Physical Geography.

9. *Evolution*.—Darwin's epoch-making '*Origin of Species*' appeared in 1859 and changed the outlook of men. The principle of Evolution is now accepted as the normal law and extended beyond organic life to inorganic matter and imponderable mental, moral and social phenomena. The other principle of Natural Selection stands on a different pedestal.

10. *Young, Mature, and Old*.—The brilliant studies of River-Systems by William Davis, the American Geologist, led him to apply these terms—Young, Mature and Old—to describe the river at different stages of its course and life. It has since been extended to many an other object of study in the physical world such as lakes and mountains. A river with its steep gradient such as a torrent is a young river ; a river flowing between its banks, graded above the stream but not so steeply and with a gentler fall, is a mature river ; and a river is old that has begun to deposit and meander, with its fall at the gentlest. These make fruitful concepts in Physical Geography.

11. *Time Element, Continuity*.—The division, 'Young, Mature and Old,' coupled with the Evolution principle has brought Time factor to the fore, and in the study of any phenomenon this question is raised, "What was it before, What is it now, and What will

it be hereafter." By this a thread of continuity is postulated and investigated.

12. *Place, Folk, and Work*.—Professor Patrick Geddes in his Lectures at Madras University has made us familiar with Le Play's ideas of 'Place, Folk and Work' as the intimately connected links which should be observed in our studies of Human Geography and especially in Town-planning. To take his own example, fisherfolk in Madras live on the shore as near the fishing grounds as may be. There the fishes come up and there it is they have to fish. You may transplant the fisherfolk to where you please but you cannot make the fishes go, too.

13. *Data-giving Sciences*.—As pointed out before, Modern Geography takes its data from others. If those change their data, Geography also must do likewise. Take this from Meteorology. Before the Great War, forecasts of Northern European weather were very wide of the mark. The Great War forced the (Norwegian) Bjerkneses (Sr. and Jr.) to have closer stations and make intensive studies. It resulted in their discovery of the Laws of Anticyclone and the weather forecasts have become reliable. It is the province, next, of Geography to note the change and infer the consequences to man flowing from reliable forecast.

14. *New Discoveries*.—It was only in the Wonderful Century, as the XIX is known, the entire continent of Africa became known and then parcelled out among the Powers of Europe; in this century the Poles have been reached and Polar regions have been explored. Such fresh knowledge should go into current Geography.

15. *Effect on Modern Geography*.—All the methods and concepts, found and applied in these hundred years, have led to a *Rationalisation* and *Simplification* and *Integration* of Geographical matter. They have led also to the discovery and application of law and order in such matters. Upon the results thus obtained has been based the scientific presentation of Regional Geography, which is so characteristic of the modern text-book and geographical studies.

16. *Modern Geography competing for its Place*.—As just pointed out, it is only within the last 100 years, one may almost say within the last generation, that Modern Geography perfected itself. As a late-comer it has had to struggle for a place in the sun

like the contemporaneously-born nations of Japan, Italy and Germany—but with juster cause and better hopes. Already it has found its level in all civilized countries, except India. And here, too, it has begun to win its place.

Section V.

Human Geography

1. *Scope of Human Geography*.—It has been pointed out above how Geography is primarily concerned with Man in general. In Human Geography, special emphasis is laid upon Man. His action and reaction to environment are brought out better, showing conditions of his life and occupations, his settlements and communications, the influence of Populations and Distributions etc. The methods of study are just the same but certain factors stand out however. 'Man is a political animal' (Aristotle)—that is to say, he lives, moves and has his being only in communities; 'he is a tool-making animal,'—tool includes weapons; he works with Mind and Will and Freedom—and clashes are therefore inevitable, creative activity alternating with destructive activity, in cycles. He has evolved a civilisation adapted to environment, with varied ways of life and modes of living together. All these features are apparent among primitive or savage communities, too, which live closest to nature. Though they are not visible on the surface they underlie the highest civilisations, characterised though they are by the dominance of mental and moral factors. As parts of Human Geography there come in also such special studies of the particular; as Geography of Dress, of the House, of Roofs, etc.

2. *Dynamic Side*.—Change is the law of life in Geography as in the world at large. It is very essential in Human Geography, to lay stress upon its dynamic character. The common text-books leave a wrong impression of permanence in and by their presentation of facts and figures as if they were things lasting for all time—as if Geography were the mere register of facts and figures or the simple measurer of the shadows cast by them. The reader of the common text-book hardly ever gets the impression that the facts and the figures it records are subject to change by every march of Time and Mind and Nature. It presents the equilibrium as stable whereas it may only be casual or dynamic like that of a spinning top. Human Geography must also take into account the fact that the mind and spirit of man broods over matter and rings in ever-new changes.

3. *Changes due to Man's Will.*—Man can make a hell of heaven or a heaven of hell. In large-scale action, Government, which represents the organised Will of the people, counts for much. In two decades (1870-90) Japan leaped into a world-power; in one decade (1895-1905) Germany became a great seafaring nation; on two five-year plans (1925-), Russia has stridden by centuries. To crown all, India, at Government's command, has, according to the Hon. Commerce Member, Sir A. Ramaswami Mudaliar, beaten record, producing in one year, half the Munition parts she requires for herself and producing also surpluses for export to others. For peace-time achievements, witness the Canal Colonies or industrialising Mysore; the Harbour of Madras or the Periyar Dam.

4. *Changes due to Progress of Science.*—Every great scientific progress has wrought corresponding changes upon Man, and the study of such effects falls within human dynamic Geography. The development of coal power has altered the face of England and led to revolutionary steamship and the railway. France, wanting coal, developed oil power and brought out the automobile. Faraday's laws being rediscovered by 1880, Hydro-electric Power has come to help countries like Italy which have had little coal or oil. Sivasamudram, Mettur, Pykara, Tata Hydro-electrics or Mandi, how they have been changing life not only in urban areas but also in the remotest villages connected by the life-giving wire!

To give a few other examples. India for ages supplied the world with indigo. German chemists succeeded in producing colours from black coal on commercial scale and the extinction of Indigo plantations followed, India herself being dependent on the cheap synthetic product and buying to the tune of several crores of rupees every year. Nitrate fertilisers are now fixed from the nitrogen of the air by the Haber Process and cheaper than Chile's. Sugar-cane bred by the Wizard Venkatraman at Coimbatore have been taken up in Bihar and U.P. and Mysore, whereby India has become self-sufficient in Sugar. Natural Rubber mentioned above as wild rubber and as 'plantation' rubber may soon have to face competition with artificial or synthetic rubber (Buna) and with substitutes found for it.

Science has increased man's power and capacity. Take the homely bicycle, first invented by a Frenchman; riding on it, a man moves faster than a horse or a Marathon prize-winner of old; a few months since, I biked at my age a hundred miles in a day

whereas I could not have done in that time twenty by walk nor have achieved a mile by runs at top-speed even with many a halt for wind, for that matter.

While Science has multiplied Man's power and capacity over matter a hundredfold, his capacity for moral good or evil has changed but little relatively. The price of that sovereign freedom, it may be, is 'blood and tears, toil and sweat.' To blame science for his retaining intact such sovereign freedom, and his heritage from arboreal ancestors or for his moral worth or want of it,—to blame science for all that seems not very just.

What power for good, for example, the aeroplane is along with the wireless, in the hands of the Canadian R.A.F. With these they blitz Berlin in War. In Peace, with these they develop the far-flung places of Canada, discover (as they have done in the last five years) nickel mines and gold mines, transporting thither all supplies, even live cows, for the support of such remote settlements, which could not have been achieved formerly in as many months as the hours the air takes.

5. (1) *Political Geography*.—Political Geography is a branch of Human Geography ; and for long, Geography has adopted political divisions as units of study, the regional concept making headway but slowly. It is an exciting, if not also a dangerous study by its allowing the intrusion of politics and the sway and play of mob-passions.

5. (2) *Roxby's Space-Relations*.—The space-relation theory recently propounded by Prof. Roxby is a remarkable explanation of many a geographical and political activity in Human Geography. A country formed into an entity has, by its very location, certain aspects only, limited in range, for contacts with other countries. Accordingly, the activities inner and outer alike are necessarily determined and circumscribed. The Expansion of European countries only on the Atlantic Sea-board can be explained only on this basis. Switzerland and Afghanistan can be cut off from the outside world. Austria, a nodal and capital state was actually so cut off after the Great War, being surrounded by the succession states which made life in it very hard indeed, whereby the Austrians themselves had to yearn for the Anschluss. Similarly the space-relation in the case of Russia, circumscribed in contacts though vast in territory, led her to the quest for ice-free port ; and that not only accounts for most European wars of the last century but has led her at last to the discovery

of Petsamo and Murmansk on the Arctic and the completion of the Russian Canal System which are 'the greatest and the longest in the world. So, too, Geography and not the British, said Mr. Churchill, has encircled Germany and so she must remain.

5. (3) *The Present War.*—The War now waging is itself a Geography War. 'Back to 1914, give back our lost lands' say the Germans; 'Back to 1919, give up your last-got-lands' say the British. 'Security!' cry the Germans; 'Security!' cry the British to the echo. Behind it all, there are two opposite Geographical Theories, both propounded by British Thinkers. About ten years before the Great War (1914) the Rt. Hon'ble Sir Halford Mackinder upon his study of the rise and fall of empires in the past, came to the view that there should be adjustment and re-adjustment of the Distribution of Lands to the Dynamism of Peoples, that the mal-adjustments have been and are the prolific parents of most wars and that if possible War should be obviated and averted. So far, both theories are agreed. The difference is in the *modus vivendi*.

The theory held by British Statesmen in general, of whom Lord Halifax, the Crusader, is a leading exponent, may be described as the *status quo theory*. Under it, the Versailles Treaty (1919) and other Great War Treaties are final, subject only to variations by consent, which should be both mutual to the Party States and ratified by *all* States; each state to be and to remain the equal of every other State and sovereign unto holding the keys of War and Peace in its hands, as in the *status quo but now protected by all*. This theory is widely held in Britain.

The other Theory given out first by Sir Halford Mackinder may be described as the Leader-Vassal Theory. Under it each small state should have affiliations with the big neighbour state and form protective groups with it. This theory is widely accepted by German Geographers and in Germany and the other Axis Powers. The term 'vassal state' is a term invented by International jurists precisely to describe the status of Cuba in relation to U.S.A., under which Cuba is nominally and to all the world as independent and sovereign as the U.S.A., but virtually in absolute submission to it. (Since the Address was delivered, *The London Times* has in its Leaders, in July 1941, veered to the Leader-Vassal theory, eliminating, of course, Germany). Such things are best studied in Political Geography.

5. (4) *The Frontiers*.—Of the dynamic side of Human and Political Geography, there is no better illustration than the Frontiers. The Frontiers are endowed with life and movement now advancing, now retreating, keeping step with the strength and weakness of a State; the show of force it can muster; or the dread of it among the neighbours.

The Political Frontiers are in peace-time defined as the farthest extent of land to which the King's writ runs, and three miles outwards by sea. For purposes of war, it receives an extensive meaning. It covers all foreign lands brought under its sheltering wings by treaties, diplomatic actions, 'leases' such as are made by Britain to the U.S.A. That is its meaning in Lord Baldwin's famous declaration that with the coming of the air, the frontiers of England are no longer the English Channel but must be sought on the banks of the Rhine. Lord Halifax made history by extending such English Frontiers in March 1939 to the River Vistula, and in the subsequent months to the river Danube and from the Golden Horn to Cilician Gates of Turkey. It is in this sense that Britain has been declared to be the far-off bastions of U.S.A., by the U.S.A. Heads of Administration.

Natural Frontiers are some Geographical Feature beyond the Political Borders that a State overgrown in Power covets as coigns of vantage or *points d'appui*, in order to dominate its neighbours; for example, Louis XIV's dictum that the natural frontiers of France are the Rhine. And so saying he annexed the Germanic Alsace and Lorraine, countries destined to shape momentously the course of Modern European History. Those hapless countries also illustrate how unstable the equilibrium is that results from such a conception of Frontiers. Along with the Balkans, they have been verily the Apple of Discord thrown by Providence under Whose especial care Britannia is, in order to make her the Greatest Power in the World, Franco-German enmity being one of the major factors in the Expansion of England (Seeley).

The Scientific Frontiers are the lines which the military experts of the day think to be safe and easy to hold. Science is progressive and military science most rapidly and explosively so. For example, the Ancient Chinese Wall proved no stronger than the Dragons guarding the 'celestial's' coast from the 'foreign devils'; the Modern Maginot Line specially built by the French as the strongest fortification the world had known, in order to guard the Rhine, proved to be death-traps to the French at the hour of trial.

But in India the Durand Line, a practical combination of all these features and more, defines the boundaries of India, Afghanistan and Russia where they meet. It has stood the test of time for more than fifty years, a record for any Frontier.

SECTION VI

Things Indian.

1. (1) *Defences.*—The Geography of India's defences may be briefly told: *India need fear no foreign enemy.*

1. (2) *Air and Sea.*—She is a member of the British Commonwealth. By her constitution, she is a friend of the friends and enemy of the enemies of the United Kingdom, whose Allies are very many and increasing. Every now and then, the *Gazette of India Extraordinary* proclaims who are India's enemies. She is too remote by Air and Sea from possible enemy bases. Britain who has taken on herself the protection of India is already the mistress of the seas and the skies, as Sir Samuel Hoare has declared. Nature herself has provided India with the best of natural defences in the world.

1. (3) *Land.*—An invasion by land by any European Power is simply unthinkable.

1. (4) *The North-West.*—The mountain ranges of the North-West are long and wide stretching 400 to 700 miles long and 50 to 100 miles wide and immensely high. The passes are altitudinous and hard to negotiate being often only 'porries' (cut winding-steps like those in the Madras Light House). Them, no Baby Austin car can negotiate, not to speak of modern tanks and mechanised forces. The tribes are freedom loving people and untameably turbulent (witness the Faqir of Ipi, whose movements are as regularly announced by the Associated Press as those of H.E. the Viceroy).

And on this side of the mountains, the attacker must stand up to one of the best armies in the world, the Indian Army, whose exploits in Dunkirk and Berbera, Sidi Barani and Benghazi (and since this address, at Amba Alagi and Beirut) have been applauded by the three Commanders-in-Chief since the War. We are ready to meet the enemy on his own ground. Baluchistan stretches its hands across the desert to Seistan and the British keep at Basrah, Baghdad and the Caucasus an incessant vigil over Iran and Iraq.

1. (5) *The East*.—On the Eastern side of India, which is now bounded by Burma India is all secure. The savagery of the untaught Nagas and the virgin impenetrable forests are too much for any wild invading tribes. Japan, the only possible invader, already feels encircled by the A.B.C.D. States. She fears their wrath. She has to fear the Soviet, too. For four years, Chang of C. (i.e., China) one only of the four letters, has almost alone defied both Wang, Japan's ally and Japan, too. If Japan overcome her fears and make up her wants of vital oils and steel, and venture out, there is Burma to overcome. Burma with the British and with Chang of China can defend herself easily. Burma treats India as foreign, by constitution and in every other way. Burma does not want us. If Burma does care, nevertheless, to have Indian help, India is ready to give it, because she must do so by her own constitution.

1. (6) *Aden and Singapore*.—Formerly, Aden and Singapore were thought to be the farthest outposts of India. The Australians claim Singapore as their bastion; the British Admiralty has taken over Aden.

1. (7) *Anywhere*.—In this War, it has been declared by H. E. the Commander-in-Chief, Sir Claude Auchinleck, that attack is defence and that India's defence is on the battle-fields of Europe and Africa, Asia Minor and Mesopotamia. In short, India's defences are now co-extensive with the defences of the British Commonwealth; and so, the battlefield may be anywhere in the world and India's Man-Power is as important a world factor as British Diplomacy.

2. (1) *Historical Geography*.—The Historical Geography of India seeks out—not the mere description of the back-ground however decorative, as in Macaulay's Clive—but with the deep-lying Geographical factors that interpenetrate the occurrences, viewing them apart from the purely mental and moral causations, such as are embodied in the saying 'From Jai Chand to Uma Chand, treason in the camp has been the verdict of Indian History.'

2. (2) *Former Empires*.—Purely Geographical causes are found to underlie the breakdown of Empires in India; the more the Empire grew, the weaker it became. It cracked under its own weight, of Magnitude and Distance. That weakened the Central Power and the weakness of the Central Power always proved fatal to the Empire in India.

2. (3) *But Now*.—But now, modern appliances and inventions have not only reinforced the Central Government in its massive strength but have multiplied manifold its limitless power. 'India is safely ruled from London by the little finger of Colonel Amery, successor to the Great Moghul' (Mr. N. Subrahmanyam at Lahore, 1939).

3. *Geographical Law of Assimilation*.—Two different peoples, however sharp their antagonisms, and however they may have come together, cannot live side by side for long time in the same land without their undergoing internally an osmotic process as it were, and digesting and assimilating the discordant elements into one harmonious whole. And out of the clashes and impacts of mind and mind and system and system, there are often born a nobler culture and a greater civilisation.

4. (1) *Hindu-Moslem Relations*.—The Hindu-Moslem relations are no exception to the Geographical law. "It has been remarked by a writer in the Asiatic Researches (Vol. VI, p. 1) that the Hindus and Moguls¹ in India, have by their necessary intercourse, become remarkably assimilated not only in manners, disposition, etc., but even in religion; and he states a very striking fact in confirmation of his remarks, namely, that Scindiah who is a superstitious² Hindu, is likewise very observant of Mahometan ceremonies" (1809). Hindus repair even to-day to Tippoo Mosque at Arcot, even as Haidar Ali had done before to the faqir, for prayers for children. So they do to Mira Saheb of Nagore (Negapatam). The Hindus in South India, though the differences are largest there observe the Moharram in very large numbers. Moslems may be seen at times to resort to Sadhanas of Hindu sages.³

The History of India of XVIII Century shows of Wars of Religion, almost none; but only Wars of Ambition and of Succession. In the course of but two years (1748-50) four Nizams, Moslems all, were put to the edge of the sword by Moslems. So was it at

1. i.e. Moslems in the Anglo-Indian vocabulary of the time.

2. That is the epithet-synonym for 'devout' in the Hindu way, among Christian writers of the time.

3. It was Tippoo, a Sultan of Islamic zeal, that gave fresh life, with cash and honours and endowments, to the Hindu *Math* of the Sankaracharyas at Sringeri upon its having been plundered and stripped bare by the Hindu Raj of Poona—(Sringeri Records). The reverence is well-known, which was paid by his father Haidar Ali to Sri Ranganatha Temple looked over by the palace at Srirangapatam. Both lived within sound of the Temple-bells and of its music and processions.

the Nawabies of Arcot and Moorshedabad. It was indeed in the opportunity given by the Moslem Fratricidal Wars that Providence made Rulers of the British traders.

Now and then the Press reports sporadic clashes of Hindus and Moslems; but they have, almost all, other genesis than conflicts of religion. (Sir Henry Emerson, Governor, at Punjab Convocation). Rather are they conflicts of people, who happen to be also of different persuasions, over objects of this Earth and not for places in Heaven.

Indian History shows also many an outside race settling in India and in the course of a few generations becoming—save for such vestigial remains as names and forms and rites—as indistinguishable as water is from water. And like water, too, how separable with ease! Such susceptibility is not peculiar to Hindu or Moslem, but a general condition of Indian Life at the present day. Under hopes of political or economic rewards, dangled like carrots before the donkey, entities can be made with ease and Entity played against Entity with still greater ease. Any Entity may have its own vote and veto; and is independent and free, like a Sovereign State of the European continent.

The Geologists' concept of 'Young, Mature, and Old' may well be applied to describe the several stages and states, at a given time, of Hindu-Moslem brotherliness in India. Examples: The Cawnpore Belt may be considered as Young; the Gujarat as Mature; and the non-tribal Sind (712 A.D.) as Old.

Sometimes, one comes across land-slides; but that, as just pointed out, is not peculiar to them but common to all Indians. It may interrupt for the *moment* but cannot prevent for *all time* the steady operation of the Geographical Law of Assimilation of Peoples by the *genius loci* and the long results of time.

SECTION VII

The Purpose and the Philosophy of Geography

1. *Regional Geography*.—We have seen how Geography is a Synthetic Science and how comprehensive it is by its nature. Its very vastness compels studies of Geography, too, in compartments, such as Physical, Human, etc. If however, Geography is to bear full fruit, there should be a Great Synthesis of all the small syntheses of Geography so studied in parts. This is achieved through the concept of *Regional Geography*.

A region is a unit of the Earth which appears to have similar geographical physiognomy under the same geographical factors. It need not be the same as a political unit which is formed for ease of ruling. For example, the plateau taluks of Palmaner, Punganur, and Madanapalle of this District along with parts of Anantapur District, makes a regional unit with the contiguous Kolar, Chintamani, and Sira of Mysore State by having the same regime, of climate, topography, origins, life and occupations, etc. But they fall under three different political units.

What elements should go into the concept of region and what not, and how the operation of each such element should be demarcated in practice or application is a matter much in controversy on which no two experts *can* see eye to eye. (Vide *Scottish Geographical Journal*, 1940). Yet by each one working it out, in his own way and on his own view and belief, there is evolved in the course of time a greatest common measure of all.

In Regional Geography, all the geographical factors bearing on the region are brought into its study and results thereof are integrated and presented in relation to that region.

By such treatment, a complete synthesis is effected, between various parts, between the role of town and country, for example, location of places and their growth, of the soil and crops, of causes and effects set out in correlation ; etc.

In such manner, by the aggregation of studies of the several component units, a satisfactory composite picture of the world in general is obtained at last. And that is the way every *modern* textbook of Geography is written.

2. *Sub-Region*.—The sub-region is to be determined where the major Region is vast and complex, as in India. But there is no agreement on what basis and how the dividing lines are to be drawn ; while Indian scientists cannot settle it, Englishmen have done so for Indian Geography ; and Drs. Stamp and Baker hold the field for the time, beside Dr. Pithawalla and Dr. Ahmad.

3. *Regional Geography of the World and India*.—Should the Regional Geography of the World or of India be studied, is a poser that is sometimes academically put. Study both, with emphasis on India. Geography fails of its comprehensive plan, were India alone to be studied. 'What do they know of England, who only England know ?' (Kipling). For any Indian to study all the World and leave out India would be to gain all the world and lose the soul—to play the *Hamlet* without *Hamlet*. In Paris

there are hotels proclaiming on the signboard "To the U.S.A. and the World" as if the U.S.A. were *outside* the world. So is it with 'India and the World.' There, however, the landlord says in effect that he prefers the dollars to the francs, the paying American customer to others. Dr. Johnson, being asked his advice upon a certain system of education, said, it was like a dispute over how to put on trousers, the left leg first in or the right; meanwhile, another put in both and got away. So it is with this question. India forms an integral part of the World and Indian Geography is studied and understood in all civilised countries.

Mr. K. Natarajan, Editor of the *Indian Social Reformer*, expresses his admiration of a system of Education in America under which a girl of 8 years old whom he met in Ann Arbor, U.S.A., was eager to know of Gandhiji, of Untouchability, etc., etc., on his being introduced to the Little Woman as a gentleman from India. 'How do you know of these things' he asked amazed. 'We discuss in class such questions once a week,' was her answer. And she was in the Primary School! (Natarajan: *My Trip to America*). Similarly, when an Indian visited a Primary School in Japan, a little Japanese girl 5 years old, who had begun her alphabets, came to him and kneeled (which is Japanese courtesy) to show respect and opening a page of her book, begged him to point out his country there. That page was a page giving the Flags of the World in colours. He pointed to the Union Jack; "No, that is England's." "Yes, it is India's." "No, No, There, you see it is written England's." He could not convince her. No more could you or I. The world comes to her ports and she could apply it and say which is which; studying Geography at first hand.

The late Justice Sir Ashutosh Chaudhuri, one of the greatest Indians, an acute thinker and a gentleman of highest culture, was astonished at being shown in the Geographical Section of the Museum at Berlin maps of Calcutta marking the scenes of every one of the Hindu-Moslem clashes that had occurred. It was patent, he said, upon the Maps, that the conflict was thickest at certain spots between Colootola Street and Harrison Road. He felt stung to shame, that he had not known of it before—he who was one of the most active and foremost citizens of Calcutta, taking always keen interest in the City and in promoting cordial relations between Hindus and Moslems. He was asked why those foci of riots being *thus* easy to locate, they in Calcutta could not anticipate them in time, nor so arrange matters there that no

riots occurred there in future—forewarned by such maps (Sept. 1922). He was overcome by such a remarkable, brilliant piece of Applied Geography of tremendous value to India. I may be permitted to add that he thereupon meditated and resolved to bring out a Reclus for India to popularise Geography and wrote to me for my co-operation. Unfortunately, he fell ill shortly after (1923) and died (1924). At the date of his visit to Berlin (1922), Germany was suffering vitally, punched and pinched for bread; yet she was as keen as ever on the bread of knowledge for knowledge's sake.

4. *Home Region.*—It is only common-sense as well as true pedagogy to pass from the known, the familiar and the concrete to the unknown, the unfamiliar and the abstract. Our first Geography must therefore be the Home Geography related to the immediate Environment; then we must go forth from Home outwards into World-Geography. And lastly we must return to where we began, the Home, equipped with the knowledge of the whole and with the tools and methods of Modern Geography. Home, Abroad, and Home again—these three stages must mark our progress in Geography. It may be truly said that Geography begins and ends at Home.

Home Geography is the culmination, but can be reached only by steep ascent. The difficulties are very great but not at all insuperable. There is no text-book to read or cram. The teacher must take more than ordinary pains to come up to the mark. There can be neither inspection, nor examination in the ordinary way, because the inspector and the examiner alike know next to nothing of the local Geography of places in their range or circle with the possible exception of one or two. We take for granted familiar matters of everyday life and do not go, behind them, to the Why and the Wherefore. The mind sees no reason for it, naturally, unless aroused or compelled to do so by comparison and contrast, etc. And it is not easy, for a man who does not look beyond his nose to separate the several underlying factors: nor is the general knowledge worth much, if it fight shy of application to Local Geography.

Yet it must be made. Only a firm grasp of Local Geography can breathe life into the study of Geography and make it more than a memory of vague things in general. Only then it can become a source of vitalising knowledge and the Geographer can render reliable service. The preparation of it even for a single

area requires the coordination of several factors and the Madras Geographical Association may well promote its production.

5. *The New World Order*.—In the creative evolution that we live under, every nation seeks to make the best utilisation of its geographical opportunities. The first step is *true* knowledge of Geography to which the State and leaders either attune themselves or fail. For example, within twenty years of its Post-War existence, Czecho-Slovakia produced locomotives, cars and guns, besides such things as came of old, paper, porcelain, glass and chemicals. It was a country about a third only in size and population, of Madras Presidency; while India whose Railway System is the fourth biggest in the world cannot produce her own locomotives.

To regard the World as a whole—an achievement of the geographical outlook—is leading one, gradually and imperceptibly, to *regard mankind as one family*, an ideal presented by Geography also, as by others. There it is, by the very conditions of life under the limitations imposed upon a region by nature.

To promote the ideal, Geography may envisage the grouping and federation of regional units so as well to harmonise also with political ambitions.

The Japanese ideal is *hakko ichi aye*, a harmonious world under Heaven,—with the rider of the Asiatic being an equal of the European. The British Commonwealth is a world in itself containing all conceivable discordant elements, brought together by historical accidents more than by design; and yet it is an association which has banished war within itself, for, by, and in spite of those discordant elements. Such success is a model to the World. We are, indeed, heading for a World State, consisting of all States, but virtually ruled by the British or Anglo-Saxons as senior partners, they alone being armed for the sake of police duties, and the rest disarmed as in India. ‘There the common-sense of most shall hold a fretful realm in awe’—there, ‘In the Parliament of Man, the Federation of the World’ (Tennyson).

This seems the most likely event to issue from this War upon the Victory of British arms. We came very near Permanent Peace at the end of the Great War. But Versailles was a Carthaginian Peace (See Lloyd George, *War Memories*; and Keynes’ *Men*) and the 14-pointed Wilsonian Peace, which held out the promise of best hopes for mankind, went by the board.

6. *War and Man.*—War is in the Biology of Life and like a tree that has sown its seed before it is dead, war sows its seed before its termination and perpetuates itself. Versailles Treaty failed because it was the embodiment of Clemenceau's Security and Vengeance ; and ignored and defied Geography, Economics, and History.

But War is ever brutal and never more deadly than now. To go to war is to go in the teeth of good-will among nations promoted by Geographical necessity and scientific advance ; in the teeth of Peoples' Aspirations and the Time-Spirit.

Although War is in the Biology of Life, War is *not*, at this latest stage of the Modern World, a biological necessity. Nature presents the ideals of Mutual Aid (Prince Kropotkin) and Conscious Planning by Man (Huxley) and Man's harmonious adjustment so as to live together (Regional Geography) and living so as not to injure others and giving everyone his due, (Roman Jurists).

Neighbourliness, as pointed out before, is in the heart and mind of a great soul (a Mahatma). But under the impacts of Geography and Science, party walls are crumbling down. And even the ordinary folks are instructed to be so, by Geography teaching them where their strength lies and their limitations ; by teaching them the philosophy of dependence on themselves and interdependence on others. This geographical lesson is an outstanding lesson.

7. *Keys of Peace and War.*—Three motives, runs a Tamil saying, begin Wars—lust after woman, land, and gold. The Rama-yana and the Iliad of woes illustrate the first ; the Mahabharata, the second ; and modern wars, the second and the third.

This *terra firma* of ours has been adjusting itself to changes of pressure, now by gradual changes, now by violent changes such as earthquakes and volcanoes. The maladjustments to changes among mankind undergo similar adjustments. The gradual adjustment is due to causes such as Geography opening up trade and commerce and promoting good-will with better knowledge. Horrible wars and fierce battles are like the volcanic eruptions, Nature's adjustments to change.

8. *Applied Geography.*—I have given before, a striking example of Applied Geography (Sec. VII, para. 3). For another,

take pandemic diseases. By Geographical method, interpreted by statistics, Dr. Russell has made it possible to forecast and forestall cholera. By geographical methods epidemics can be located, and their course arrested ; people educated and armed with such knowledge, will compel and see to the performance of duties by those concerned or responsible *not omitting* themselves. As for what an *awakened* public *conscience* may do, look at the recent action against the Croydon Council, to which an outbreak of typhoid was traced ; over £200,000 damages were awarded against it for its neglect of typhoid precautions. Geographical correlation of Disease and Slum must result only in their cleaning up as the first of civic duties.

9. *The True Geographer*.—A true geographer is one who is competent by true knowledge to be of help ; not necessarily one who has scored 30 or 40% marks. I have learnt to respect as true geographer the village school-master who gathers and understands geographical facts of his place, upon geographical methods, and makes them available. It is such a man that sheds the beneficent radiance of Geography and by such men, Modern Geography finds its fulfilment and vindication in this country. I met such a man, I am happy to state, on my way here and he is a clerk in a Taluq Office.

10. *Geography is Knowledge not action*.—Be it remembered that like other subjects of school and college, Geography is knowledge and not action. I say it, and say it again, lest there should be mistake. Geography finds its scope in the sphere of *knowledge* ; its aim and purpose is to create *right* knowledge. Action involves exercise of the *will*. Geography helps the will with knowledge but does not operate upon the will. It is needless to say that many an other element goes into the making of an act or a fact, besides *right* knowledge.

11. *Geography takes note of man's creative activity*.—We are everyday living Geography, without our knowing it, like Moliere's character, Jourdain, who on being told he was talking Prose all his days, was lost in wonder that he had been doing so really, Prose being, in his belief, something apart. Geography may be made high and holy, too, but need not necessarily be so.

Geography sees as a whole and notes with wonder the handiwork of man. When the first tramway was laid in Madras, it carried its wires underground. The first tram ran past our Col-

lege. The College peon saw it and wondered. "I have seen in my day," he said, "the first railway ; it had, at any rate, an engine and blazing fire and belching smoke. But here is a thing that moves of itself. Surely, surely, the White Man is a God or a Magician. To endow life-less matter with life and movement !" In vain, the Science Master, the virile Alasingaperumal, could convince him, with illustrations and apparatus, that it was not so but an ordinary application of Science. The peon shook his head and replied, "These also are further proof of the White Man's power !" Man's work is like God's or Magician's creative, and the wonder is inherent in the work and lost only through familiarity. Geography draws attention to man's creative side, not merely to his passive reaction to environment.

12. *Dependence and Interdependence.*—Since man lives in communities only, and these again, in larger and larger groups, he cannot be really independent in any absolute sense ; such independence as he often proclaims himself to possess is, in truth, dependence viewed in blinding lights from particular angles. Man is bound each to each, and each to all, in bonds of natural piety. Apposite is the Indian Parable of the Hermit and the Loin-cloth. There was once a Hermit who renounced the world retaining of it only a pair of modesty-cloth, just enough to cover the loins. Stealthily there came a mouse, and gnawed one of the two pieces to rags. It set the sage a-thinking : " Well, to frighten the mouse, a cat is wanted ; to feed the cat, a cow is wanted ; to tend the cow, a shepherd ; to cheer the shepherd, a shepherdess ; to keep the couple from harm, a constable ; and then in like order a court, a king, a kingdom." And he went on meditating, link by link, through the entire chain till it terminated in the Universe. " I can see it now," exclaims the sage at last, " I can see it now : for the loin-cloth's sake, the Universe itself is wanted " (*kowpeena samrakshanartham idam prapancham*). The story forcibly brings home the chain of Man's Dependence.

The bountiful gifts of Nature are strewn with prodigal hand but not all things are bestowed on *one and the same* region. Not even the U.S.A. is self-contained for War (e.g., tin, rubber, etc.) and man—as is best exhibited and taught in the Lessons of Geography—takes Nature's gifts and makes use of them as best as may be, by a process of ceaseless adaptations. To cite a familiar example—Man makes his food of what his own region yields him; Rice in monsoon lands, and wheat in the temperate ; date in the

hot desert and meat in the cold; fish in land and water and *erschatz* in the famines of war.

No region being self-sufficing, the wants of one region may be supplied by the surplus of another; and this is effected by war and peace; by conquests; by migrations; by trade and commerce; etc.

And that is not all. In this neo-technical age of ours, the technician multiplies manifold, nature's own gifts, and provides man with ample means of well-being. The fault for bringing about a disturbed and agitated world lies at the door of Politics and Power-race and such other controlling factors. But Nature's own plan is dependence and interdependence.

13. *The Cultural Value of Geography*.—Even those of the highest spiritual illumination have been vouchsafed a vision of the World as an integral part of their spiritual discipline; e.g., Arjuna; Buddha; Jesus; and many saints that attained beatitude. The Prophet had his fill of Geography, travelling in the caravan service of the noble Dame, Khadijah. Geography by opening 'Windows into the world wonderful' vouchsafes a Vision of the World to the matter of fact man-in-the-street; brings all the earth before his eyes; enables him to gaze also upon the wonders of man's achievement upon earth; and helps him to look at 'Life steadily and as a whole' in terms of Arnold's definition of Culture. Geography is a universal subject of universal appeal; a necessary and an informative one, for that matter; and it is for one and all.

14. *Philosophical*.—Many theories have been built upon geographical studies. One such is that Philosophy of Geography which points to the varied gifts of nature, and observes that the very variety appears to impose upon man, the principle of inter-dependence. Religion binds man to man through Heaven, through love, through God and His works. A similar function is performed by Geography but with the humblest means at his disposal. For, like Religion, it, too, binds man to man through love and even hate; through the Earth; through the things of the earth, earthy; through the works of Man and all the wonderful bounties of Nature.

Physiographic Divisions of India

By

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(Dr. Pithawalla proposed a scheme for the physiographic divisions of India, which was the subject of discussions at the sessions of the Indian Science Congress held at Lahore in 1939^a and at Benares in 1941. The scheme has been severely criticised and Dr. Ahmad^b showed at Benares that it was quite unacceptable. He has suggested an entirely new scheme in its place.)

Physiography has been variously defined and there has been a great difference of opinion as to the precise scope of this science but there is a strong disposition to regard physiography as another name for physical geography. By some physiography is restricted to narrower limits being regarded as the physical geography of the land.¹ As Wadia has put it "Physiography is that branch of geology which deals with the development of the existing contours of the land part of the globe."² In a scheme of physiographic divisions "relief and land-forms"³ should make the main basis of classification. These are obviously the result of the work of various geological agents on the structure of the country.

According to relief India falls under four major divisions:—

- (i) The Mountains of extra-peninsular India, comprising the Himalayas in the north and their offshoots in the north-west and the north-east.
- (ii) The great alluvial plain of northern India, commonly called the Indo-Gangetic plain.
- (iii) The Deccan Plateau.
- (iv) The coastal lowlands.

(a) Published in the *Journal of the Madras Geographical Association*, 1939.

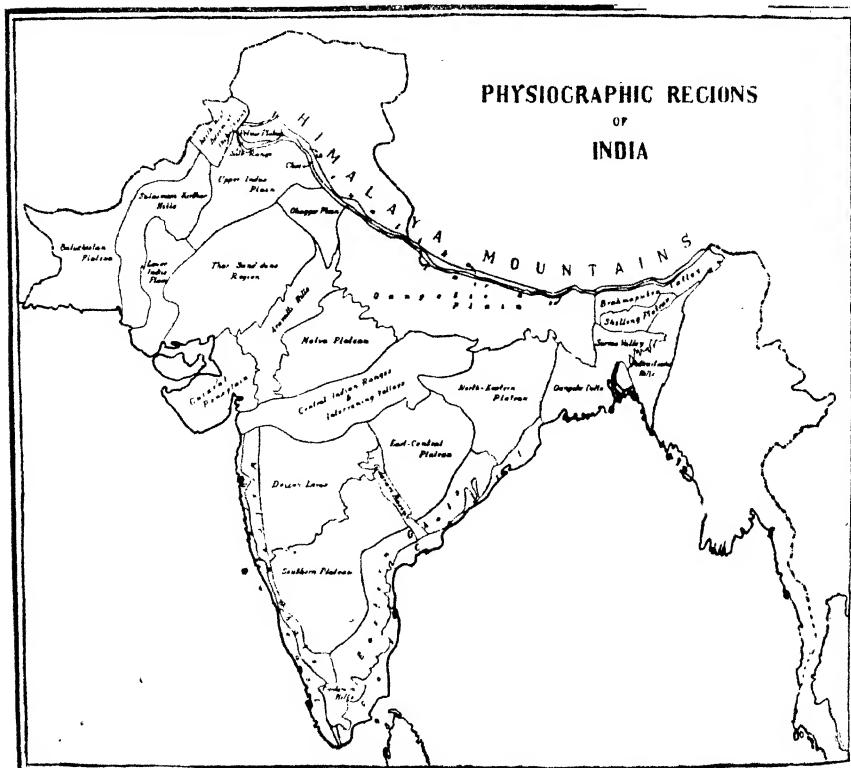
(b) For his criticism of Pithawalla's work see the proceedings of the Indian Science Congress, 1941.

1. Physiography by Salisbury, page 3.
2. Wadia, *Geology of India*, page 308.
3. Using the word physiography in the narrow sense.

To divide India into physiographic regions each of these major orographic divisions may be sub-divided on the basis given above.

I. Mountains of Extra-peninsular India

(1) *The Himalayan Mountains*—A belt of snow-covered new folded mountains extending from the Pamirs in an unbroken wall for over 1250 miles in the north of India. In a region of 100 to 150 miles wide the Himalayas consist of a series of more or less parallel or oblique or even converging ranges intersected by numerous transverse valleys and extensive plateaus. It includes all the ranges lying to the north of the Siwaliks—the crystalline and metamorphic zone of the lesser main Himalayas as well as the marine fossiliferous lying behind it. The whole region has been subjected to successive compression and has suffered great contortion and presents a great complexity of land-forms. The Scenery is marked by a monotony of steep slopes and ridges, occasionally relieved by a bold bluff, or a rocky gorge or a wide longitudinal valley.



(2) *Siwalik region*.—The Siwalik ranges are the most recently folded superficial hills which topographically belong to the

mountain area but geographically to the plains. They consist of fresh water sediments, laid down at the foot of the Himalayas, similar in nature to those underlying the plains of Northern India. They represent a period of continental sedimentation. There has been no metamorphism of the strata beyond the hardening of the lower rocks by age. They are easily eroded and have been laid bare of soil in areas of deforestation. They are easily distinguished from the main Himalayan region by their low height—about 3,000 to 4,000 ft. Excepting a short distance of fifty miles opposite the basin of Tista and Raidak, the Siwaliks have been shown to skirt the Himalayas throughout their length from the Brahmaputra to the Indus and even beyond it. The width of the zone varies from 5 to 30 miles. In some places they are pressed against the lesser Himalayas and are not easily identified but frequently they are separated from them by longitudinal fertile valleys called the Duns, e.g. Dehra Dun, Kalka Dun and Kangra Dun, etc. The outer margin of the Siwaliks is everywhere fringed with a belt of gravel deposited by the streams draining the hills, which is known as *Bhabbar*.

(3) *Suleiman-Kirthar hills*:—A zone of new folded low hills mostly bare or devoid of soil cover, formed of hard lime-stone and sand-stone, here and there alternating with bands of shaly rocks. They are of simple structure. They do not show the complex inversion and thrust planes met with in the Himalayan region! They are an expression of the work of running water in an arid climate acting on land of different hardness. There are many narrow steep-sided gorges, and even in broad open valleys numerous runnels of water have carved out gullies. Another feature of the region is the prevalence of great gravel slopes known as *Dhaman*,⁴ fringing the foot of the hills. The mountain hinterlands are wild and hard both in relief and climate.

(4) *North-west intermont high plains*:—North of Suleimans, the continuity of the hills is broken and they grow transverse to the Indus demarcating the plains of Bannu and Peshawar, which lie in the basins of the Kurram and Kabul rivers. They are very fertile. The two are separated from one another by the hills of Kohat.

(5) *Potwar Plateau*:—A plateau about 1,000 ft. above the Indus Plain south of the Salt Range. It is covered in the centre

4. It may be compared with the Bhabbar.

with alluvial deposits; in other parts a rock-strewn plain from which project here and there isolated hill ridges and thin narrow ridges of rocks. A frequent type of ridge in Potwar consists of a single bed of some resistant rock standing more or less vertically like a wall of stone, often carved and fretted in a fantastic manner. The surface is greatly cut by deep ravines in the soft Siwalik beds, which the whole area is composed of. Extensive deposits of gravel sand and silt exist and many large erratic blocks are found.

(6) *The Salt Range* is a lofty scarp forming a crescent ridge to the Potwar plateau, disturbed by faulting and minor folding and exposing representatives of most of the great systems from Cambrian to Tertiary. Southward over-folding and thrusting is a dominant structural feature.

The crest of the range forms a plateau which is more or less undulating and is cut into by stream valleys. It has a unique scenery of vividly bare rocks.

(7) *Patkai-Lushai hills*:—On the eastern border of India, a series of hills generally with a north-south strike lie from Patkai to Lushai hills. They were formed along with the Himalayas and consist of tertiary shales and sand-stones. Contrasting with the hills of the western border their physical landscape is associated with that of a damp climate at all seasons.

(8) *Shillong Plateau*:—The Shillong plateau is a detached fragment of the peninsula. A gneissic mass it forms a wedge occupying an acute angle between two regions of contortion. The Rengma (mikir) hills are separated from the main plateau and provide a passage for the cyclones.

II. *Indo-Gangetic Plain.*

(9) *Tarai Region*:—East of the Jumna south of the gravel slopes of the Bhabbar is a swampy region caused by the issue of water which has percolated underground through the Bhabbar. It is known as Tarai. It is a narrow belt with varying width on the average less than 5 miles.

(10) *Chos Region*:—West of Jumna, on account of a diminished rainfall the Tarai region is absent and gives place to a sandy region 15 to 25 miles in width occupied by non-perennial hill torrents known as *chos*. They pour down into the plain in the rains at almost every mile. Rising generally in the Siwaliks they form a network of sandy beds which become less and less marked with increasing distance from the hills. The *chos* beds in

the plain are broad rivers of sand with very slight fall. The beds are often non-existent or at the best composed of unstable sand liable to be washed by any flood. Except for floods they are dry throughout the year.

(11) *The Upper Indus or Punjab Plain*:—It consists of the valley plain of the five rivers. Owing to the greater fall in their gradients the deposits of the rivers are very sandy and their character tends to diminish the pluvial denudation of the surface by allowing the water to sink into the soil. The high banks of the rivers are frequently capped by hills of wind-blown sand, known as *Bhur*. The action of winds upon the sand of the river, the formation of *Bhur-land* and the elevation of the ground in the neighbourhood of the river banks, are exhibited in this plain to a greater extent than in the Gangetic plain. Rivers have carved their valleys in the former deposits. In the interfluves or *doabs* land gradually rises from the river banks till it culminates in central uplands which are called "Bars". The bar tracts were previously desolate scenes of rolling sand-dunes, patched with grass and glistening with salt and formed waste lands. Large portions of them have now been converted into fertile tracts with the extension of irrigation. The subterranean Delhi-Shahpur ridge divides the plain into two sections: the eastern one has a higher water-table with attendant landscape. Incidentally it has also a higher rainfall.

(12) *The lower Indus Plain*:—This region has been demarcated from the upper Indus plain at the narrow out-let of the Indus waters west of Jaisalmer. The surface of the Indus alluvium in upper Sind differs but little from that of the Panjab and considerable portion of the area is flooded annually and the whole drainage of the river is there confined to a comparatively narrow tract. Some permanent marshes of large size also exist.

This section of the Indus plain contains a very important physiographic feature. The river between Sukkur and Rohri has cut its way through a low range of lime-stone hills, surrounded on all sides by alluvial deposits. A barrage has completely revolutionised the economic structure of this region. Situated in an arid climate this region is in general a gift of the Indus, and now in particular of the firm banks of Sukkur.

Below Hyderabad lies the delta which may make a good sub-region. In this the channels of the river frequently change, more frequently perhaps than in the Gangetic delta.

(13) *The Ghaggar plain*—Between the Sutlej and the Jumna lies the Ghaggar plain, drained by the Ghaggar and other minor streams most of which lose their water by evaporation or seepage within this plain. The whole work done by them is expended within the area and none of the detritus from the Siwaliks is carried beyond this area. All the southern part of this plain where the final evaporation takes place is extensively impregnated with saline matter ; so good drinking water is scarce.

On account of the flatness of the country, in no part of the Indo-Gangetic plain have more important changes taken place in the courses of rivers than in this area. Encroachment of sand from Rajputana in the south and from the chos region in the north is gradually contributing to the dryness of the area.

(14) *Gangetic Plain*—The whole expanse of this plain with unvarying monotony, has been formed by the alluvium of the Ganges and its numerous tributaries, deposited on dry land accumulating to a thickness of over 3,000 ft. The deposits are continental. The greater portion of it is composed of *Bhangar*⁵ land through which the rivers have cut *Khadar*⁶ valleys.

The Bhangar surface is, as a rule, nearly flat but is much cut by ravines in the neighbourhood of rivers. From the form of the plain it is obvious that over large parts of the area rivers have been more important as agents of denudation cutting their channels deeper and deeper in the Bhangar, the alluvium of which was formerly deposited by the streams of the same drainage and at a time when the main rivers flowed at a comparatively higher level.

A characteristic of the clayey parts of the plain, particularly in the older deposits, is the abundant disseminations of impure calcareous matter in the form of irregular concretions, known as *Kankar*.

(15) *Gangetic delta*—It is a natural continuation and the wide development of the Khadar of the upper portion of the river. Here the river ceases to carry and collect but begins to drop and distribute. Its course is marked by scattering silts and shifting channels, with widespread floods in the rainy season. The whole region is further characterised by the abundance of large swamps or Bils, which occupy the old channels. The river has gradually

5. Old alluvium.

6. New alluvium.

shifted its bed from the western towards eastern Bengal and so the geomorphological aspect varies according to the degree and nature of its activity.

West of the main stream into which the Brahmaputra falls lies the old delta of Central and Western Bengal. In the Western Bengal, beyond Bhagirathi-Hoooghly, there has been interference with the natural action of the river by large quantities of silt brought by the rivers of the plateau on account of its reckless deforestation and the creation of artificial embankments. This has prevented the completion of the natural process of land formation. These extensive and intricate embankments carry with them the danger of floods. In Central Bengal a large area has been raised above the flood level and the process of land formation is almost complete. It is a region of dead and dying rivers and the conditions are regulated by the recession eastwards of the Ganges and its affluents. Here the problem is to secure in the old channels a continued and adequate flow of water.

In the Eastern Bengal lies the new delta, where the river is still vigorously active in land formation. It is a typical delta region, covered by a network of rivers, streams and creeks. Here the marshes or *jhils* are more extensive and the banks of the streams less consolidated. In the rainy season a great part of the area is flooded and a rich deposit of silt is extensively spread over the country. Only the river mounds which are used for habitation appear above the water.

The Surma or Sylhet valley along which the Brahmaputra formerly flowed, may be demarcated as a sub-region with all the physical aspects of the new delta region excepting the existence of distributaries.

(16) *Brahmaputra Valley*:—It is a gigantic khadar, the greater portion being liable to flooding. The river divides and reunites many times. On either side of it there is a belt of marshy land, lying at some distance from the river. There are, however, here and there higher tracts, at some places mere mounds, rising a little above the general plain, and at others small plains.⁷

III. *The Deccan Plateau.*

(17) *Thar Sand-dune region*:—Between the Indus and the Aravallis lies the great arid tract of India known as the Thar

7. Which may be called *bhangar*,

desert. It is covered with a great thickness of aeolian deposits, and sand-dunes form the characteristic feature of the landscape. It provides a notable example of the evolution of desert topography within comparatively recent geological times. Here the powerful insolation and wind action have been dominant as agents of denudation. There is an abundance of debris and a general absence of soil and humus with peculiar sand-blasted and treeless landscape.

In the east and north numerous rock hills of low elevation crop out from expanses of sand and silt, dotted at long intervals by salt lakes. These rocky projections belong to the old rocks of the country. In their bare, bold rounded outcrops and sand-blasted topography they present a striking illustration of the phenomena of wind erosion.

(18) *Aravalli hills*:—This region is composed of crystalline and metamorphic rocks of great antiquity, for the most part much altered and quite unfossiliferous schists and quartzites. All are folded together in complicated contortions.

The Aravallis are an excellent example of an old-folded mountain complex reduced, by long and continuous degradation, to little more than the wreck of a mountain range. The original Aravalli mountain was a folded range of pre-Vindhyan age, which was eroded and either partially or completely base-levelled in pre-Vindhyan times. It was rejuvenated as a horst along a pair of roughly parallel boundary faults either in the Purana or Dravidian periods. A large portion of the region in the northern half is now covered by pleistocene and recent deposits and here low flat stretches of land are frequent.

(19) *Malwa Plateau*:—It includes the whole area lying in the east of the Aravallis and north of the Vindhyan range and consists of rocks of varied age and structure, archaean granites and gneisses, Vindhyan sandstones and Trap lavas occupying most of the area. It is a low undulating plateau 1,000 to 2,000 ft. in height. Near the Gangetic plain the plateau dwindles into a country of broken relief, the whole dissected by deep gullies and ravines which generally carry water only for a short while. The whole region drains towards the north-east.

(20) *Central Indian ranges and Intervening Valleys*:—It includes the belt of high lands lying east and west in Central India, on either side of the Narbada-Son trough. The Vindhya and their continuation, Kaimur hills border it on the north; and the

Satpura and its continuation Mahadev and Maikal hills on the south. Further south lies the Valley of the Tapti which is bordered by the Ajanta hills continued eastwards by the Gawilgarh Range. The highlands form escarpments towards the Valleys and are generally residual in origin. Outcrops of basalt and sandstone are predominant features of landscape.

The intervening Valleys of Narbada and Tapti, whether the result of subsidence or denudation, are long and narrow. They provide quite a big area of low relief and are in a large portion covered with fertile alluvial deposits.

(21) *Deccan lava*:—A region of flat relief. It is covered by fertile black cotton soil formed by the disintegration of basalt which lies underneath. The soil cover is quite deep. In the dry season when the soil shrinks, deep and wide cracks appear all over the area.

(22) *North-East Plateau*:—It includes Chhota Nagpur and the adjacent parts of Orissa and Central Provinces. Here there is a wide distribution of coal-bearing lower Gondwana rocks and metaliferous Dharwar rocks. In this region are found the principal coal and iron mines of India.

(23) *East-Central Plateau*:—This is partly covered by the Purana and partly by archaean rocks. The former have been much worn down to constitute the Chattisgarh plain in the upper Mahanadi basins. The Dharwar rocks are rich in manganese and iron ores.

(24) *Lower Godavari Valley*:—The linear tract of lower Godavari, an important zone of sedimentation in carboniferous times, contains outcrops of important coal-beds. Limestone is also found associated with the area.

(25) *Southern Plateau*:—South of Godavari basin and Deccan lavas lies a large area of archaean rocks in which highly folded and foliated immeasurably old gneisses and schists and plutonic rocks have been exposed. Of rocks, sedimentary in origin, the Cuddapahs, in a crescent between the Penner and the Kistna, and the long outcrops of Dharwar rocks further west, are important.

The whole surface of the country presents a gently undulating aspect, characteristic of an ancient land surface. Locally there may be found scarped residual hills cut by narrow steep-sided

valleys or sharp-crested ridges rising from the plains. Great granitic tors and bosses are found here and there to give variety to the general aspect of the country. The valleys, with a few local exceptions, are broad and open and the gradients of the rivers low. The soil cover is thin. The region gains in height towards the south.

(26) *Western Ghats or "Sahyadri"* are residual mountains running parallel to the west coast throughout its length, only interrupted by the Falghat Gap across which they are known as the Cardamom hills. They form an imposing scarp or cliff with its steep side facing the Arabian sea.

They consist, to the north, of horizontal or nearly horizontal strata of basaltic rocks, cut into a steep scarp on the western side by denudation and similarly eroded, though less abruptly, on the eastern side. Where horizontal strata of varying degrees of resistance are subjected to sub-aerial denudation precipitous square-cut peaks abound and give a fantastic appearance to the scenery of the Ghats.

South of about 16° N, with the change in the geological formation, the horizontal igneous rocks disappear, and the range is composed of ancient metamorphic strata. Here in some places there is a distinct connection between the strike of the foliation and the direction of the hills but the connection is local. It is denudation which has played the principal part in determining their contours.

(27) *Eastern Ghats* consist of a group of hills more or less isolated from each other though sufficiently in line to demarcate the table-land from the plain below. They are very complex in structure. The chain as a whole has no separate existence. It is composed of several plateau scarps and small isolated ridges of metamorphic rocks separated from each other by broad plains and having in reality but little connection with one another. Some of these scarps are surviving relics of ancient mountain chains elevated contemporaneously with the Aravallis.

From the coast there is an abrupt rise inland somewhat similar to that of the Western Ghats though on a smaller scale. They are scattered, broken and of much inferior altitudes. Occasionally they throw spurs which break the coast into headlands.

(28) *Gujarat peneplain*:—It consists of two distinct sections —Kathiawar and Gujarat proper. Kathiawar, consisting mostly of

Deccan traps and jurassic limestone is rough and hilly while in Gujarat the older formations have been planed down and buried under pleistocene and recent deposits.

IV. *Coastal Lowlands*

(29) *West Coast*—It consists of a narrow strip between the Western Ghats and the Arabian Sea. Whether a submarine plain or one of marine denudation formed by wearing down of the edges of the tableland, it consists in its northern part of the Deccan lavas and in the south of archaean gneisses and granites, with fringe of recent deposits on the coast of Malabar.

The northern or Konkan part, lying in front of the lava-capped Ghats is relatively firm, unbroken, narrow and more or less rough. Numerous short swift streams which flow down from the Ghats have each formed their alluvial fans while the waves which beat against the shore during the period of south-west monsoon have piled up sand banks against them. The cover of alluvium is not continuous as many spurs from the hills spread themselves out to the coast.

The southern portion of Malabar is a land of lagoons fringed with sand-dunes. Great heat and high humidity are very effective in the weathering of the metamorphic rocks which constitute the Western Ghats in these latitudes and provide plenty of sand.

(30) *East Coast*—The east coast is a submarine plain which has emerged out of the sea with the general epeirogenic uplift of the peninsula; the whole is covered by the alluvium brought down by the rivers. The formation of deltas is a conspicuous feature of this coast.

It may be also divided into two sections. The east coast north is structurally narrower, with the delta of the Mahanadi in the north and the deltas of the Godavari and the Kistna in the south. Between the deltaic flats of the Mahanadi and the Kistna the plain is interrupted by many small hills or inselbergs consisting of the same ancient rocks as the plateau. Mangrove swamps occur along the deltas.

The east coast south has a broad stretch of flat land near the sea which consists mainly of alluvium. Further inland small hills appear which are of ancient crystalline rocks like those of the plateau.

Cities and Towns of Bombay Province : Aspects of Urban Geography

By

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[Note : Increasing urbanisation is a general feature of modern Civilization. While natural barriers as mountains, river crossings, deserts, conditions of water supply, and natural route concentrations were some of the geographical factors influencing the urban development in the past, Industrial and Commercial Expansion, Administrative and Social Centralisation have become the new forces in the evolution of Modern Urban Agglomerations. In U.S.A. and to some extent in Western Europe, Town is essentially a modern phenomenon. This paper aims at explaining the geographical factors underlying the evolution of towns of the Bombay Province (including Gujarat, Deccan and S. M. C. States). The discussion is on regional basis. "Cities" with a population of one lac and over or those which have been declared as "Cities" by the Local Government, and "Towns" with a population of ten thousand and over, have been studied in detail, with an outline reference to their site, "Economic base," and evolution. "Towns" having a population below ten thousand have been considered only for the purpose of determining the "Urban Zones."]

That the Bombay Province is the most urbanised of the major provinces of India is shown by the fact that the total urban population of the Province is 22.6 per cent of its total population, while the figures of other provinces range between 20 per cent and 3.4 per cent of their respective total population.¹

This urban development of the province is naturally due to the growth of the city of Bombay and the cities and towns of Gujarat, Deccan and Karnatak. Geographically, as Vidal de la Blache points out, considerations of defence, natural barriers like

1. *Census of India*, Vol. I, page 46. For the purpose of regional survey Gujarat and S.M.C. States have been taken into account.

deserts, mountains, rivers and natural route concentrations and administrative centralisation form the purely local influences which determine the "siting" of cities,² while considerations of "space relation" constitute the larger environment which shapes the growth of urban areas and determines their tone. But these environmental factors themselves are liable to change from time to time, and in fact urban development in every country is characterised by such changes.³ A study of urban geography therefore must take into account not only the problem of "siting" but also factors of larger environment like social needs and communications.

HISTORICAL EVOLUTION OF THE BOMBAY TOWNS

Historically, defence and commerce by land and sea routes, have been the major influences in the origin and development of our towns. The first urban development in Bombay was essentially coastal. The ports of *Honawar*, *Chaul*, *Bassein*, *Broach*, *Balsad*, and *Cambay* are mentioned in the historical accounts of Hindu India as prosperous commercial centres trading with the Persian Gulf and often bearing the seats of local government. In the interior however defence and administrative convenience determined the pattern and evolution of towns. From North to South, *Kaira*, *Kapadwanj*, *Godhra*, *Baroda*, *Nasik*, *Kolhapur*, and *Badami*, were capitals of Hindu kings. Commercial centres were very few. Only *Dohad* a 'border' town between Malwa and Gujrat, *Lunawada* at the junction of routes through Malwa and Gujrat, *Kolhapur* "entered by nine roads" and mentioned as "Tagar" by Ptolemy, and *Badami* where there was a chamber of commerce in Chalukyan times, are mentioned as leading trade centres.⁴

With the rise of the Bahmani and Mogul power urban interest shifted further East in the interior. *Bijapur* and *Ahmadnagar* in the South, and *Malegaon* and *Ahmadabad* in the North rose to importance. Khandesh developed the Commercial centres of *Nandurbar*—where the English established their factory as early as in 1616—*Dhulia* and *Jalgaon* and the famous handicraft centres of *Yeola* and *Dharangaon*, mainly because Khandesh tract linked through the Satpura range, the Imperial capital of *Delhi* with the

2. P. Vidal de la Blache: *Principles of Human Geography*, page 473.

3. Jones and Bryan: *North America*, p. 364.

4. *Bombay Gazetteer*. Vol. XIV, p. 306.

rich commercial provinces of Southern Gujrat, where the trade with the Persian Gulf and the Makka Pilgrimage had developed the famous port of *Surat*. Similarly other ports of Gujrat had their share of prosperity when the trade of the Malwa and Central India tracts began to pass, under the Imperial rule, through them.

Maratha rule did not influence urban development to any great extent although the rise of defensive sites like *Satara* and various minor towns selected by the Maratha chiefs and local powers, as administrative centres must be mentioned. It is significant to note however that only *Chopda* and *Vairag* are mentioned as new commercial centres during this period.

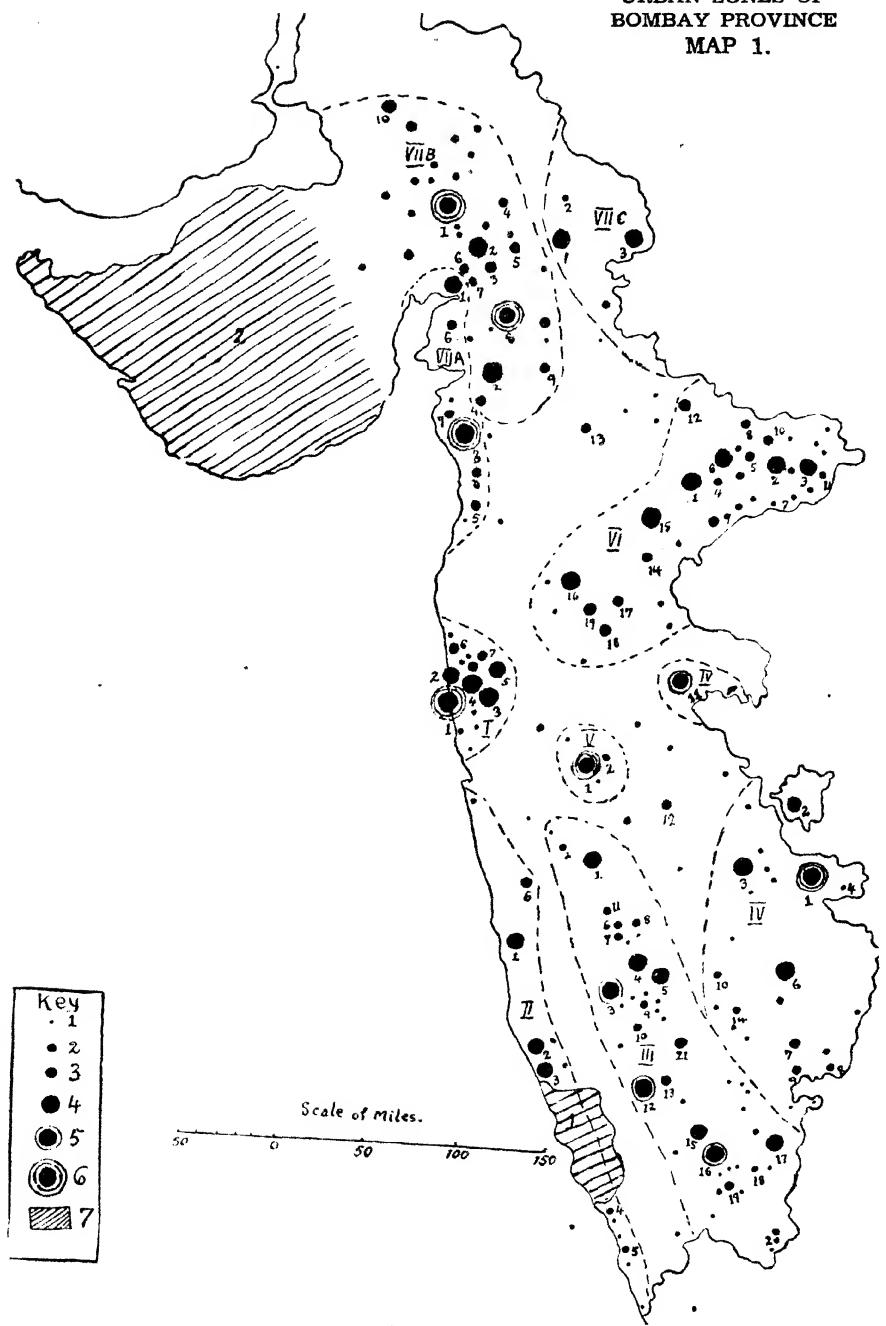
DEVELOPMENT OF THE BRITISH RULE AND GROWTH OF COMMUNICATIONS

Development of the British rule and growth of road and rail communications brought about a great transformation in the relative importance of different towns. Initially, establishment of English factories in Gujrat and Konkan gave a stimulus to the ports of *Surat*, *Bombay*, *Chaul* and *Karwar*. But it was followed by increasing monopolisation of maritime trade by *Surat* and *Bombay*. There was a corresponding decay in all other ports and this in its turn injured in no small measure the ancient prosperity of Gujrat. Construction of North and South roads in the interior gave a new stimulus to the settlements at the junction of the Ghats and the Eastern Plateau. Railways again, particularly in the Khandesh region, favoured the urban growth and created prosperous urban centres at nodal points.

In explaining the rise of modern cities Munro points out that "steam, steel and credit have made the modern city possible;"⁵ in Bombay Province credit has certainly been an important factor, but the influence of industrialisation over urban growth is limited in extent. The growth of three cities only can be attributed to industrial expansion: The average urban settlement of the Province is a commercial town usually with a historical background and often now supported by administrative and social centralisation. This is clear from the following regional analysis which gives us seven well demarcated urban zones.

5. Munro: *En. of Social Sciences*, article on 'City.'

URBAN ZONES OF
BOMBAY PROVINCE
MAP 1.



1. Towns under 5000; 2. Towns between 5000-10000; 3. Towns between 10000-25000; 4. Towns between 25000-50000; 5. Towns between 50000-100000; 6. Towns over 100000 and 7. 1. Goa; 2. Kathiawar States.

1. Bombay Metropolitan Region; II. The towns of the Konkan Coast; III. The S.M.C. and Karnatak Zone of Contact Towns; IV. Sholapur Industrial Region; V. Poona; VI. The Khandesh Zone of Commercial and Indus-

1. THE BOMBAY METROPOLITAN REGION

The transfer of the Salsette area to the East India Company and the change of the Company's headquarters from Surat to Bombay, brought the Island into prominence, and now along with Calcutta it is the foremost of the Indian cities. The rise of the port was due to the Thana creek. Less than five fathoms deep, its main advantage has been the protection it gives to the harbour from the open sea. Railways and roads constructed during the period 1852-1885, like the arms of an octopus, created a vast hinterland to the port, and gave it a complete monopoly of trade of the major part of India. The American Civil War and the extended cultivation of Indian Cottons created a local textile industry, the causes of localisation being financial enterprise by local merchants, ease in transport of cotton from Gujarat, Khandesh and Karnatak, and economical import of sea-borne coal from Durban. Administrative centralisation, educational institutions, social amenities, and a high proportion of earning population, have further contributed to the growth of the city; and in spite of the defective localisation of the Cotton Industry,⁶ the competition of *Ahmadabad* and *Sholapur*, and the development of Cochin and the Kathiawar ports, Bombay is not showing any material decline in its urban character.

A great increase in population has resulted in rise of land values, and crowding within the Island, which exhibits all the characteristics of a great metropolitan city. "Fort" is the central "core" where administration and commerce find their localisation.⁷ In its neighbourhood are the fashionable shopping and amenity centres such as cafes and cinema houses. The tapering southern end of the island is marked by residential and governmental buildings. To the north of this central core, begins a continuous thickly populated area in the centre developed on religious and community basis. Along the Eastern coast is the harbour side with its docks, depots, whole-sale grain markets and oil installations, while the Western shoreline is dotted by rich residential dwellings owing to the advantages of the Western breeze and vantage points on the hills.

Further north lies the industrial zone of Bombay with its mills, railway workshops and ancillary industries and the working class

6. Vakil, Bose and Deolalkar: *Trade and Industry in Modern India*, p. 134.

7. P. Vidal de la Blache: p. 476.

area. Pressure of population and limitations of space within the Island were mainly responsible for the Backbay Reclamation, but suburbanisation has proved the real solution. The first suburbs were developed on the Northern edge of the Island. Railways and their subsequent electrification have thrown open a much greater area for suburbanisation and the growth of "satellite" towns, which are mainly "dormitories" and residential areas of the middle class population. Such are the suburbs of *Bandra*, *Santa Cruz*, *Andheri*, *Malad*, on the B.B.C.I., and *Kurla*, *Ghatkopar*, *Thana*, on the G.I.P. joined together in a network by a "ribbon" development throughout.⁸

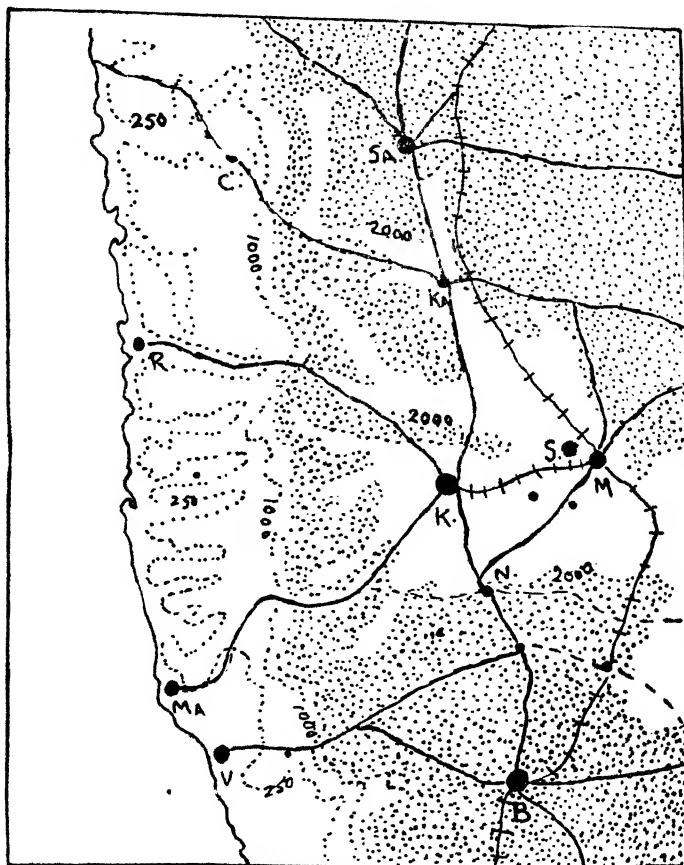
A recent trend of much interest is the rise of a variety of industries in the suburban areas owing to the natural tendency of the manufacturers and importers of avoiding high customs duties on "completely manufactured" goods, the high land rents in the city, and dockyard charges, without sacrificing, however, the advantages of finance, trade, and commerce, that the city affords. Such are, to mention a few, the motor works at *Sewri*, match factory at *Kurla*, Chemical Works at *Ambernath*. Evidently *Bombay* is showing all the signs of a future conurbation, which will absorb the satellite towns of *Bassein*,—once an ancient and prosperous port,—*Bhiwandi*, *Kalyan* and other minor settlements.

A feature of the *Bombay* Metropolitan Region is the complete absence of urban development on the *Kolaba* Coast beyond the Creek. It must be explained as mainly due to the absence of facilities in land and water communication between the Island and the Coast of the mainland.

2. THE TOWNS OF THE KONKAN COAST

South of *Bombay* lies a string of little ports along the Konkan coast, once prosperous in a maritime commerce, but now mere appendages to the Metropolitan City, *Chaul*, *Bankot*, *Vijayadurg*, *Karwar*, *Kumta*, *Honawar*, and *Bhatkal*, which were famous as ports in the Hindu and Mahomedan period. A glimpse into their prosperity during the early British period can be had from the accounts of travellers and of the East India Company's servants who were put in charge of the factory set up by the Company in this region.

Mouths of the Konkan rivers were favourable sites. Products of the Deccan Plateau and Ghats as the famous "Kumpta" cotton and spices were transported by land routes across the Ghat passes and shipped to Arabia and the Mediterranean through these ports. With the progress in oceanic navigation, Bombay proved a serious rival. The old ports were inadequate to modern navigation. Development of off-shore bars across the creeks and river mouths and heavy silting have further reduced the utility of these ports. Karwar retains some of its natural advantages and it would have maintained its prosperity, had the plan to connect it by rail to Dharwar and Hubli in the sixties of the last century materialised.⁹



MAP 2.

Towns of the Konkan Coast and the 'Contact' Zone of S. M. C

B. Belgaum ;	K. Kolhapur ;	N. Nipani ;	S. A. Satara
C. Chiplun ;	M. Miraj	R. Ratnagiri	V. Vengurla.
KA. Karad ;	MA. Malwan ;	S. Sangli ;	

9. *Kanara Gazetteer*, p. 26.

In the interior, the towns of *Pen*, *Mahad*, *Chiplun* and *Rajapur*, owed their rise to their position as "Gap" towns controlling the Ghat routes from the Konkan side, where in the days of cart traffic they were the halting places to cart caravans. Railways on the Plateau and the development of motor traffic mainly at the expense of the age-old cart traffic, have now rendered them unimportant.

The coastal towns of *Ratnagiri*, *Malwan* and *Vengurla* however owe their stable position to their being administrative and educational centres. *Vengurla* like *Karwar* and *Honawar* has also a good coasting trade.

A striking fact about the Konkan region is that in spite of the great density of population, urbanisation has taken little root.¹⁰ The disintegrating influence of relief, absence of good hinterland, railway development on the Ghats and general poverty of the population must explain this phenomenon.

3. THE SOUTHERN MARATHA COUNTRY AND KARNATAK ZONE OF CONTACT TOWNS

This region offers an interesting corroboration to La Blache's generalisation that the line of junction between two contrasted natural regions promotes a string of settlements which brings the two regions into mutual economic contact by means of commercial functions. *Karad*, *Kolhapur*, *Sangli*, *Nipani*, *Belgaum*, *Dharwar*, *Hubli*, *Haveri* and *Ranenbennur* are primarily commercial centres situated at those nodal points where the Trunk road from Poona to Bangalore meets the commercial routes from East to West. From the point of local commerce, they are the "bottle necks" through which the products of Konkan must exchange with those of the Desh tract. From the point of inter-provincial and foreign trade they are the feeders of Bombay, where local produce is collected and despatched by rail by the agents of Bombay merchants. *Kolhapur*, *Sangli*, *Belgaum* and *Dharwar* are also administrative centres. *Hubli* with its population of ninety thousand owes its rapid progress partly to commerce but mainly to cotton industry, and the railway workshop. Railway has strengthened this commercial bias and the nodality of all these towns. *Satara* and *Gadag* are two outliers of this zone, while minor towns like *Tasgaon*, *Jam-*

10. Eg. the Karwar Taluka has a population of 64105: and a density of 229 persons per square mile.

khandi and *Mudhol*, retain their urban appearance because these are the chief towns of the S.M.C. States chosen by their rulers in Maratha days as defensive positions. Others like *Islampur* and *Rabkavi* are local commercial centres many of which were known for their handicrafts.

4. THE SHOLAPUR INDUSTRIAL REGION

Within this region lie the Industrial city of *Sholapur*, the commercial centre of *Barsi*, *Pandarpur*, the famous place of pilgrimage and the historical towns of *Ahmadnagar* and *Bijapur*. There are minor commercial centres as *Athni* and *Baglkot*, and towns of *Guledgud* and *Ilkal* famous for their handwoven textile products. Only *Sholapur* is industrial but other towns are grouped in this zone mainly because they are in intimate economic contact with this city. Seasonal migration of the *Bijapur* population to *Sholapur* and establishment of ginning factories in these towns bring them closer to *Sholapur* than to any other city.

The rise of *Sholapur* has been sudden and remarkable. In 1851 it had a population of thirty thousand,¹¹ when it was a commercial town. The opening of S.E. branch of G.I.P. Railway made it a cotton collecting centre. Cotton from the surrounding regions, a cheap local labour supply and ease of transport were the factors favourable to localisation and expansion of the Cotton Textile industry. The steady and rapid rise of *Sholapur* after 1900 must be therefore attributed to this industrial expansion. With a population of a lakh and a half to-day, it has the distinction (?) of being the only city of the Province predominantly depending on industrial activities.¹²

Barsi, on the political border, has considerable transit trade between the British and Nizam's territories. *Pandarpur* like other religious centres is showing signs of slight decline. *Bijapur* the capital of the Adilshahi kings had its heyday when it was according to Mandelslo one of the greatest cities in the whole of Asia in 1638.¹³ Aurangzeb's sack of the city and the subsequent Maratha raids reduced it to a settlement of ruins. Under the British rule, its selection as District Headquarters in 1876 was the

11. *Sholapur Gazetteer*, p. 489.

12. *Census of India*, Vol. IX, 1921, p. 78.

13. *Bijapur Gazetteer*, p. 587.

main cause of its revival. Commerce followed in the wake and only during the last three decades has it returned to the stage of being called a town.

5. POONA

To the north of the S. M. C. zone lies the famous historical city of *Poona*. If Munro's description of the modern city as "an endlessly complicated phenomenon" is to be applied to any city of the Province, it holds true of Poona.¹⁴ It is the historical and cultural centre of Maharashtra. Brought into prominence by Balaji Baji Rao Peshwa as his capital, it was still a union of four or five villages in 1757, according to Du Perron, with a common market and some one-storeyed houses. The later conquests of the Marathas brought fresh glory to their capital. Welsh in 1801 describes it as a city with a population of six lakhs, rich, gay, and prosperous. But the fall of the Marathas seems to have brought down a very rapid decline. Hamilton in 1820 speaks of Poona as a city of 150,000 persons. Jacquemont twelve years later describes it as a dirty city with a population of fifty thousand. But since 1872, with the growth of communications and administration, the historical factor has been supported by other influences; and now as the seasonal seat of the Provincial Government, as a cantonment town and a centre of trade and education, Poona is steadily growing in importance and absorbing the neighbouring settlements. Its population of ninety thousand in 1872 has risen to two lakhs and a half in 1931. Strangely enough modern industry, the most powerful influence in urbanisation, has remained practically unimportant and a variety of other influences has created the modern city.¹⁵

The site of *Poona* or *Punyapur* is an ancient one. Situated at the confluence of the Mula-Mucha, originally it had a beautiful natural setting. But it remained an average settlement till the time of the Peshwas. It was the charm of the surroundings and the more central position of the place in relation to the growing Maratha Empire, rather than considerations of defence, that induced Baji Rao to make it the Peshwa capital. But now due to influences, administrative and cultural in nature, Poona has outgrown

14. Munro : *En. of Social Sciences*.

15. *Census of India* 1921, Vol. IX, p. 75.

the original site, and the 'Greater Poona' now absorbs the towns of Kirkee, Bhamburda, Yerrowda and Cantonment area. Again the old core of Kasba remains distinct as centre of trade and site of the Peshwa administrative buildings. Civil administration and cantonment have created a large middle class. Educational facilities and historical associations of the city have induced the 'Pensioners' to make Poona their permanent home. A variety of industries, fashionable shops and hotels have sprung up under the patronage of this class, and the economic base of the city to-day is really complex.

6. THE KHANDESH ZONE OF COMMERCIAL AND INDUSTRIAL TOWNS

Considering the density of population, the degree of urban development in this region is surprising. Historical causes for the evolution of towns have been already explained. Railway development and cotton cultivation, and good labour supply have promoted the urban settlements as commercial and of late as industrial centres. *Dhulia* was a fortified settlement before it was selected as District Headquarters by Briggs in 1848, and from 1878 only it began to assume its present urban form. *Bhusawal*, *Chalisgaon* and *Manmad* once average settlements¹⁶ show how towns can grow rapidly when they are chosen as railway junctions. *Amalner*, *Dharangaon* (where the famous 'jinifaf' cloth used to be produced in the Mughal days and where there was an English factory) and *Jalgaon* owe their rise to the modern textile industry.

Nasik and *Malegaon* are outliers of this zone. On the highway between *Bombay* and *Central India*, these are commercial centres, although in the past defence was the chief factor in their growth.

7. THE TOWNS OF GUJRAT

Gujrat has played a great role in the past. As a rich agricultural land characterised with centres of famous handicrafts, it

16. In 1872¹ *Bhusawal* and *Chalisgaon* had a population of 6804 and 3914 respectively; *Manmad* had a population of 3790 in 1881.

attracted the attention of many invaders. Its position in relation to *Delhi* and Central India, the maritime benefits derived from the Gulf of Cambay, and the broad river mouths which afforded suitable sites for ports, were responsible for its high commercial prosperity in the pre-British period. Great urban development therefore was a natural result of this prosperity.

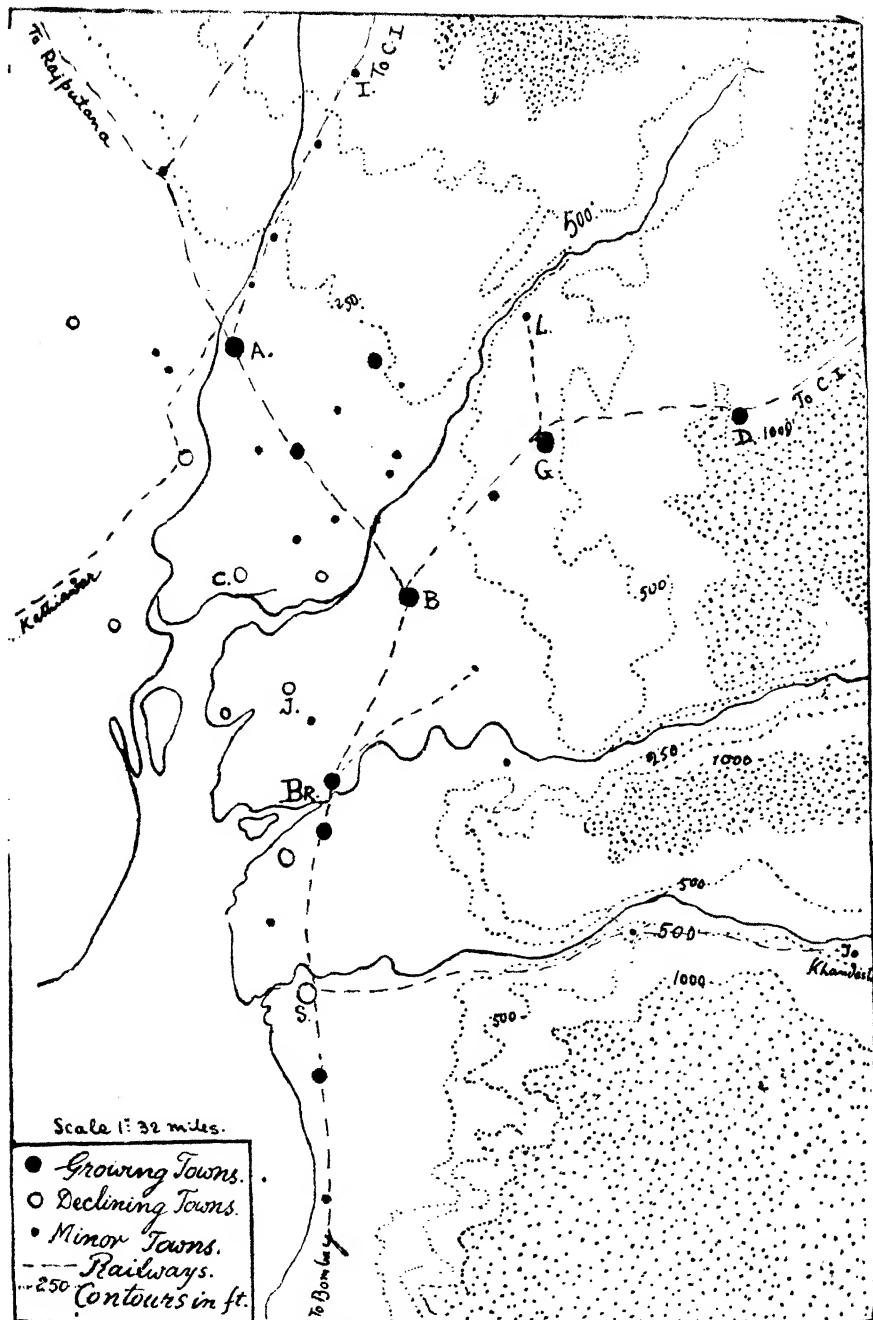
Regionally from the coast onwards into the interior, three types of urban agglomerations may be distinguished :

- (i) The ports of the Gulf of Cambay ; (ii) Nodal points of the interior ; and (iii) the 'border' towns connecting Gujrat with Central India.

(i) *The ports of the Gulf* :—Almost every important river mouth has witnessed the rise of a port, obviously due to advantages of site and hinterland. *Surat*, *Broach* and *Cambay* rose to importance owing to the possibility of navigating larger vessels into their harbours, while others remained more or less as feeder ports depending on a coasting trade.

Cambay at the mouth of the Mahi has a long history of prosperity. The rich flat doab between the Sabarmati and Mahi was a good hinterland from whence used to be exported agricultural products like rice, coconuts, mangoes and articles of luxury like ivory, carvings, lacquer work, silk and gold thread, and 'Cambay' stones. Its imports consisted of gold and iron, perfumes and spices, and woollen cloth. The gradual silting up of the Mahi and the rise of *Surat* in the 17th century reduced its trade considerably and its former glory was further destroyed by the railway construction of the 19th and 20th centuries, which has diverted the traffic and trade through *Anand*. Even in 1880 it was described as a town with "dull trade and few industries."¹⁷

Broach like *Cambay* is an ancient port. Situated on the right bank of the Narmada and with a rich hinterland it became the natural outlet for Southern Gujrat. Commerce encouraged many local handicrafts. As a seat of Hindu Kings, it was later strengthened by a fort. But its decline seems to have set in very early in point of time due to silting of the river mouth. In 1777 it is spoken of as a large town with fifty thousand souls. In 1812 its population declined to thirty-seven thousand. In recent times railway and administration have somewhat arrested its



MAP 3. Towns of Gujarat

A. Ahmadabad ; BR. Broach ; D. Dohad ; I. Idar ; L. Lunawada ;
 B. Baroda ; C. Cambay ; K. Godhra ; J. Jambusar ; S. Surat.

decline. Population has increased during the last fifty years and inland trade has restored a part of its former prosperity.

Surat.—Situated on the left bank of the Tapti, the famous factory town of Surat has an interesting position. The bend of the river near its mouth has given the harbour a sheltered position and the city is situated on a slightly rising ground along the bank. It rose to importance only in the Mughal times when the land routes from Golkonda, Burhanpur, Agra and Allahabad and the sea routes from Ceylon, Madras and Bengal were developed. Its prosperity as an “Emporium of trade” led the English to found their factory in 1612. Accounts of European travellers and merchants tell us that the city reached its peak prosperity in 1658-1707. Then followed an unsettled period during which Surat had chequered history. In the later period although the decline of the Mughal Empire adversely affected the city, under the English management its trade and commerce were maintained till the rise of Bombay and the beginnings of the railway era. Its decline was also due to the silted mouth of the river which gradually became unsuitable even to the larger sailing vessels before the days of steamships. When the port could not receive larger vessels, *Rander* stole a part of its trade. But its importance was partly restored when *Swally Roads* directly at the mouth of the river was developed by the East India Company as an auxiliary port from which goods from ocean-going vessels used to be shipped in small crafts to the port proper. To-day, however, it is more or less a stagnant city with a variety of industries, partly depending on its historical inertia and the new administrative developments.¹⁸

The minor ports of *Tankari*, *Rander*, *Navsari* and *Billimora* are hardly of any importance than as straggling towns depending on coastal trade.

(ii) *Nodal points of the interior*.—In the interior we come across a zone of towns which owe their rise to favourable river-crossings and nodality in communications. The urban agglomerations of *Ahmadabad*, *Baroda*, *Patan*, *Mehasana*, *Dholka*, *Kaira*, *Nadiad*, *Anand*, *Kapadwanj*, *Urmeth* and *Dabhoi* are primarily such commercial centres.

18. *Census of India*, 1921, Vol. IV, p. 74.

Ahmadabad :—Situated on the left bank of the Sabarmati, Ahmadabad is the second major city of the province. Its early urban growth was due to its position as the first suitable and direct crossing by the northern route from Central India to Gujarat and Bombay.¹⁹ Under the Mughals it was the flourishing capital city of Gujarat Subha having a large trade with other parts of the Empire. It was a home of famous handicrafts. Its fortunes declined with the fall of the Empire, and by the beginning of the British rule, it was in a state of decay. Since the last quarter of the 19th century, however, it has switched itself on to new prosperity. Localisation of textile industry has again brought the city into prominence and it can boast of a population of three lakhs. As a commercial centre it enjoys an advantageous position. Rich cotton tracts in the neighbourhood, good labour supply, and a commercial class full of enterprise have created a Cotton Textile Industry which may soon outstrip even the Bombay Textiles.

The town within the old city walls with its characteristic 'Pols', remains a distinct and densely crowded unit. Outside the walls the city has extended practically on all sides but particularly along the Sabarmati. Rail and road bridges across the river have brought the other bank of the river within easy reach, and extension along this side is also taking place.

A reference to the comparative table shows us that Ahmadabad is primarily getting industrial. Industry has promoted other aspects of urban life, and with its industrial and social background, Ahmadabad, like Poona in Maharashtra, represents the culture and prosperity of Modern Gujarat.

Baroda.—Baroda with reference to its site and functions, occupies a similar position to that of Ahmadabad. The major portion of its prosperity is due to its being the capital of a leading Indian State. Other centres in this zone are commercial towns and naturally their progress is mainly due to Railway development.

(iii). *The Outer Zone of the 'Border' Towns*.—This outer or Eastern zone of towns mainly consists of those settlements which owe their selection and rise to defensive positions and com-

19. *Ahmadabad Gazetteer*, p. 250.

mercial depots. Most of them are on the hilly border which separates the region of Malwa and Central India from Gujarat, and as such these control the commercial and strategic routes between these two contrasting regions. Such are the towns of *Idar*, *Lunawada*, *Jhalod*, *Dohad* and *Godhra*. Most of these became fortified towns under local chieftains because of their strategic position in guarding the routes. Most of them were in good state of prosperity, but railways have now conferred unequal benefits over them. In general the Ahmadabad routes of the B.B. & C.I. and the Khandesh route of the G.I.P. and the Tapti Valley Railway have made this tract commercially unimportant. From the point of local commerce railways have conferred a boon upon Godhra by making it a nodal point, but have snatched the prosperity of Dohad when the line was carried up to Ratlam ; and except for Godhra in these days, other towns are retaining their urban appearance solely because they are the administrative centres of the smaller Indian States of Gujarat.

MAIN TRENDS IN URBAN DEVELOPMENT.

Finally it is interesting to notice the main trends in the urban development of the Province. In the larger equation between Man and Nature, the urban agglomeration has played a decisive role in human history. The 'City' ancient and mediaeval, represents yet another human attempt to overcome the forces of Nature by systematic co-operation and corporate living. Its modern successor too, true to its economic environment shaped by industrial revolution, represents a 'large scale' attempt to harness the forces of Nature. But there is a difference. While a natural obstacle or the need for defence determined the site of the city in the past, the modern city of the American type, as La Blache points out, is a creation of preconceived planning.²⁰ The urban agglomerations of the Bombay Province obviously belong to the former category, though, it must be conceded, they are much smaller units than the cities of the West. (i) Most of them owe their origin to defence or commerce. Only 'later, they gained administrative and very often religious importance. Their progress, however, due to a variety of causes, was necessarily slow, and even to-day they remain towns of moderate size. (ii) But in the modern period, their economic base has undergone a good deal of transformation. Administration and social

20. *Principles of Human Geography*, p. 478.

centralisation have become greater bonds of urban cohesion than defence or commerce. But each of these forces, in their superimposed pattern, has left its impression on the average town. A dilapidated fort, an old but partly revived "Peth"—market—, a prominent but partly neglected temple, the vestiges of the past prosperity, and administrative offices such as the Collector's or Mamlatdar's Katcheri, schools and modern shops, the marks of modern time, characterise almost every town of the Province.

(iii) Industry, however, in spite of the impact of the West, has not contributed much to this urbanising process. Only *Sholapur* may be called a truly 'industrial' city. Other cities are composite pictures where one urbanising factor is overlaid on the other, with the general result that the city presents a 'blotched' appearance. (iv) Cities with industrial bias have recorded a substantial growth. In two types of urban agglomerations, prosperity based partly on commerce but mainly on industry is in evidence. (a) The cities of *Bombay*, *Ahmadabad*, *Sholapur* and *Hubli*; and (b) The towns of the Khandesh region. (v) But two zones of decay are also discernible: (a) The Gujrath ports which have practically succumbed to the influence of *Bombay*; (b) A belt of towns in the S.M.C. tract from *Islampur* to *Guledgud* the decline of which is difficult to account for. Isolation from railways and decaying handicrafts in certain cases, seem to be the main causes. (vi) To the general impression that there has been an exodus from the rural areas to urban centres statistics lend little support. Although there have been many changes in the relative position and importance of many urban settlements, the percentage of the total urban population to the total population of the region has not materially changed during the last fifty years.²¹

21. *Census of India*: pp. 38-41.

APPENDIX A.

TOWNS (1931)

According to zones (Towns with a population of 10,000 and over

I. *Bombay Metropolitan Region*

(1) Bombay 1161383; (2) Bandra 43290; (3) Kurla 30311; (4) Kalyan 26291; (5) Thana 21816; (6) Bassein 12689; (7) Bhivandi 15617; (8) Ville-parle 11290.

II. *The Towns of Konkan Coast*

(1) Ratnagiri 23906; (2) Malwan 29817; (3) Vengurla 20158; (4) Karwar 16122; (5) Kumta 14534; (6) Chiplun 13056.

III. *The S.M.C. and Karnatak Zone of Contact Towns*

(1) Satara 26379; (2) Wai 11760; (3) Kolhapur 69860; (4) Sangli 29818; (5) Miraj 26465; (6) Karad 14479; (7) Ashta 11251; (8) Tasgaon 110111; (9) Inchalkaranji 11904; (10) Nipani 17857; (11) Islampur 10737; (12) Belgaum 41890; (13) Shahapur 11704; (14) Jamkhindi 15523; (15) Dharwar 41671; (16) Hubli 89982; (17) Gadag-Betgeri 45852; (18) Laxmeshwar 10622; (19) Savnur 10933; (20) Ranabennar. 16,967; (21) Gokak, 11,866.

IV. *Sholapur Industrial Region*

(1) Sholapur 144654; (2) Barsi 27610; (3) Pandharpur 29460; (4) Akalkot 10851; (5) Mangalwedhe 10539; (6) Bijapur 39747; (7) Bagalkot 15597; (8) Ilkal 14267; (9) Guledgud 16756; (10) Athni 13561; (11) Ahmadnagar 41890; (12) Baramati 14170.

V. Poona (City) 198078; Kirkee 16302

VI. *Khandesh Zone of Commercial and Industrial Towns*

(1) Dhulia 39939; (2) Jalgaon 34375; (3) Bhusaval 27989; (4) Parola 12277; (5) Dharangaon 18542; (6) Amalner 23491; (7) Chalisgaon 16808; (8) Chopda 18434; (9) Erandol 12382; (10) Yawal 12751; (11) Nasirabad 14753; (12) Shirpur 10938; (13) Nandurbar 16919; (14) Manmad 12277; (15) Malegaon 32462; (16) Nasik 48704; (17) Yeola 16751; (18) Sangamner 15355; (19) Sinnar 10773.

VII. *Towns of Gujarat*

(i) Ports of the Cambay Gulf:—(1) Cambay 31877; (2) Broach 34276; (3) Surat 98936; (4) Ankleshwar 12023; (5) Balsar 19481; (6) Jambusar 11734; (7) Rander 12344; (8) Navsari 14937.

(ii) Nodal points of the interior:—(1) Ahmadabad 310000; (2) Nadiad 34584; (3) Anand 11660; (4) Kapadwanj 16536; (5) Umreth 14779; (6) Borsad 13191; (7) Dholka 13743; (8) Baroda 112860; (9) Nandod 11236; (10) Mehsana 10393.

(iii) Eastern Gujarat:—(1) Godhra 35110; (2) Dohad 22093; (3) Lunawada 11896.

APPENDIX B

CITIES OF THE PROVINCES

Growth of Population: 1881-1931

		1881	1921	1931
Bombay	..	773196	1175914	1161383
Ahmadabad	..	137041	274007	313789
Poona	..	144340	214796	250187
Surat	..	109844	117434	98936
Sholapur	..	59890	119518	135574
Hubli	..	36673	69206	89982

APPENDIX C

OCCUPATIONAL DISTRIBUTION OF POPULATION

(Per 1,000 of population)

	Bombay	Ahmadabad	Poona	Sholapur	Surat	Hubli
Agriculture	1%	36	83 (88)	65 (80)	28	137
Industry	25%	514	194 (271)	546 (671)	467	137
Transport	6.4%	25	58 (43)	37 (33)	24	128
Trade	11.8%	205	146 (116)	110 (72)	202	200
Professions	2.2%	18	52 (61)	26 (19)	71	36
P. Administration	2.7%	17	73 (81)	20 (22)	21	24
Domestic service	3.8%	58	66 (61)	15 (28)	53	13

(N.B. :—1.—Figures relating to occupations "Insufficiently described" have not been included.

2. Figures relating to Bombay are shown on percentage basis and are exclusive of the number of dependents.
3. Figures are based on the 1921 Census when an Industrial Survey was undertaken in the cities. Similar figures are not available in 1931 Census except in case of Poona and Sholapur (which are given here in brackets).

GENERAL REFERENCES :

1. *Imperial Gazetteers.*
2. *Gazetteers of the Bombay Presidency.*
3. *Indian Year Book, 1940.*
4. *Census of India, 1921, Vols. VII, VIII and IX.*
5. *Census of India, 1931, Volume I.*
6. *References to Municipal Boroughs.*

'The Aborigines of the Tarai Region

By

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Lying at the foot of the Siwaliks and the outer Himalayas, though not separated from the plains to the south by any well defined feature, the Tarai Region is a separate geographical unit. It is different in its climate, soil, structure and even the people who inhabit it.

The basic population of practically the whole country consists of a dark, short and broad-nosed race, with wavy but no woolly hair. In the east and north-east of India its identity has been obscured by the filtration of Mongoloid race through Sikkim and the Brahmaputra valley. In the Gangetic plain the type is traceable throughout the population, and the element grows in strength towards the east.

"The only immigrating race of practical importance is that of the Aryans, whose advent and progress are indirectly, and to a great extent conjecturally, revealed in the collection of their invocation handed down from perhaps as early as 3,000 B.C. in the Rig-Veda."

It appears that a number of conjugate tribes of northern race and pastoral habits migrated into the Punjab, where they settled after dispossessing the dark tribes in occupation, relegating them to the position of slaves and helots, and forcing them to migrate to the more inaccessible parts in Southern India, the Chota Nagpur hills, or deep into the forests on the north-east. Very soon the Aryans lost touch with their original country and began to develop a new civilization in their new environments. The comparatively easy conditions of life in the sub-tropical circumstances, and the almost practical immunity from attacks and enemies "combined to soften the northern fibre of the race," and in course of time, the powers of the chieftain were transferred to the priest. Religion took the first place in their life and the Brahman got the absolute supremacy.

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But India was subjected to several such streams of invasion, each forcing the previous invaders to leave the settled area, and, becoming homeless, press their predecessors. They went deeper into the forests and formed colonies, while the Dravidians, adapted to forest life had to shoulder the brunt and to run before them. These Dravidians were not only ignorant of the art of agriculture and even domestication of animals, but were hardly in the stone age of civilization.

No two races of man, living in the same land for centuries, can possibly remain without coming into direct contact. The Dravidians mixed with the Aryans and produced the Aryo-Dravidian type, while those who had already receded too far to the north-east met the Mongoloid race and produced the Mongolo-Dravidian type.

The Tarai Region is inhabited by the Aryo-Dravidians in the United Provinces and Bihar and by the Mongoloids and the Mongolo-Dravidians in the region of northern Bengal. When the Aryans built the caste system under the Brahmans, these aborigines and the new types were classed as 'Shudras' and 'Mlecchas' and preferred to remain out of their reach rather than to meet with persecution at the hands of the fairer race.

The Aryo-Dravidians in the Tarai Region are represented by the Tharus, the Bhuksas, the Bhars, etc., of the Mongolo-Dravidian type we have the Kooch; while the Lepchas, the Limbus, the Mechs, the Khambus, etc., all belong to the true Mongoloid stock.

Sir H. H. Risley has described the three races mentioned above in the following words: In the Aryo-Dravidian type "the head form is long with a tendency towards medium. The average index varies from 72.1 in the Kachi and Koiri of Hindustan to 76.8 in the Dosadh of Bihar The distinctive feature of the type, the character which gives the real clue to its origin and stamps the Aryo-Dravidian as racially different from the Indo-Aryan is to be found in the proportion of nose. The average index runs in an unbroken series from 73.0 in the Bhuinhars of Hindustan to 88.7 in the Musahar of Bihar. The statistics of height lead to a similar conclusion. The mean stature of the Aryo-Dravidian ranges from 166 c.m. in the Bhuinhars to 159 c.m. in the Musahars, the corresponding figures in the Indo-Aryans being 174.8 and 165.8. The one begins where the other leaves off."

"The Mongolo-Dravidian is one of the most distinctive types in India and its members may be recognised at a glance." The cephalic index "varies from 79.0 in the Brahmans of Bengal to 83.0 in the Rajbansi Magh The mean proportions of the nose range from 70.3 in the Brahmans and Kayasths to 84.7 in the Mals and 80 in the Kocch. The number of high individual indices brings out the contrast with the Indo-Aryans and points to the infusion of Dravidian blood The stature varies from 167 in the Brahman to 159 in the Kocch of the sub-Himalayan region."

"On the northern and eastern frontier India marches with the great Mongolian region of the earth. Neither Bengalis nor Assamese have any stomach for fighting, they submitted tamely to the periodical raids of the hill people, and the only check upon the incursion of the latter was their inability to stand the heat of the plains. They occupied, however, the whole of the lower ranges and held the 'Duars' or the gates of Butan. Thus in the eastern Himalayas none of the plains people made good their footing within the hills, which remains to this day in the exclusive possession of the races of the Mongoloid type.

"The prevalent head form is broad but the mean indices show some remarkable departures from this type. The Jaintia index is 72.9, and several tribes have indices between 75 and 80 The mean (nasal) index ranges from 67.2 for the Lepchas to 86.3 for the Khasias Under the head of stature there is nothing much to remark. The Gurungs (169.8) are the tallest and the Miris (156.4) the shortest of the tribes included."

"Progress in civilization demands that the people raise a variety of food and raw materials, and accumulate a surplus on which to live while making new discoveries and taking new steps in advance." If one such step fails they should not die of starvation. It also demands that the people be able easily to travel about so as to get ideas and materials from other places and other people and to give them what they have attained. Energy is essential for progress, and strong seasonal contrasts necessary to stimulate activity and infuse energy.

It is therefore comparatively recently that the aborigines of the region have begun to practice what has been called by Huntington the "hoe and tree culture." "Such people drop the seed into the holes punched with a stick, and grub up the weeds with

a hoe, but do not employ animals to plough or cultivate the soil." Often they cultivate the field only for a year or two and then abandon it in favour of another which has been freshly cleared and burnt.

"One great hindrance to tropical and sub-tropical agriculture is the vast number of fungi, insects, birds and beasts which devour the crops or otherwise destroy them. In wet weather, however, not only is it difficult to manipulate the damp, sticky soil, but even when the roots are dug up they take root again at once. This fact together with the poverty of the soil, and its tendency to become sour or otherwise unfit through the accumulation of bacteria accounts for the prevalence of 'shifting agriculture' among the aborigines of all countries. They cultivate the field for a year or two and then abandon it. The first crop may be good, but the second is much less abundant, and the third may be scarcely worth harvesting. Even if the slight supplies of plant food are not exhausted and if the soil still remains sweet, the field may be completely clogged by grass. In certain areas even the work of clearing the new fields is very difficult. The nominally dry season is often so rainy that after the trees and bushes have been felled they do not become dry enough for burning before the genuine rainy season comes again. When that is over, so much new wood has grown that the work of clearing the land must be done all over again.

Even if the conditions are not so bad as all this, it requires a high degree of persistence, energy and intelligence to overcome the handicap of poor soil, bacterial diseases, insect pests and weeds." When the poor aboriginal has raised his crop, he has to face yet another set of difficulties which are absent in the cooler regions. The white ants, the mice and other rodents are too numerous and beyond the control of the poor primitive man with his earthen and wooden pots.

There still remains a factor which is always active against the primitive people in the tropical and sub-tropical regions, it is the variety and the quality of the food. This lazy and indolent type of man has got to depend on a very small number of food products, and in the selection of these the first consideration is the comparative ease with which they can be obtained. He never has any idea of the nourishing properties of different substances and simply takes them to satisfy the demon of hunger.

"The main trouble with the tropical fruits, however, is the excessive amount in which they are taken when available. Many a child may eat little except bananas for several days in succession." But the quality also counts. Almost every available stuff in the tropics is inferior in nourishing properties to those of the temperate regions. The banana, guava, or the mango cannot compare with the apple or the orange. The cereals too are inferior. "Millet, maize, or even rice are starch foods, by no means so well balanced as rye, barley, wheat or oats." Meat could compensate for several deficiencies, but their all-devouring habit makes them take it raw or putrid and rotten. The excessive quantity of ale that they consume is more harmful than anything else. Childbirths, christenings, marriages, deaths, sowings and reapings of crop, etc., are all accompanied by ceremonies in which wine is freely used and in which its excess is appraised.

Over and above all these handicaps comes their superstition. If a man falls ill he suffers from 'evil eye' or the anger of some God has got to be propitiated by worship or sacrifice. A contagious disease is the greatest havoc with them, for the biggest sacrifice and the most tiring worship will not remove it.

Living under such unavoidable circumstances, toiling under such odd handicaps, and labouring against such natural forces it is no wonder that the poor Tharus, Bhars, Bhuksas, Lepchas, Limbus, Mechs, etc., have remained so backward in their arts and crafts, agriculture and industries, religion and culture.

Ethnologically the tribes of the Tarai Region have been divided into the three types mentioned above, but culturally there can only be two divisions, and only one of these interests us here. The two classes are:—

1. Those who have become completely Hinduised, have settled down in villages, invite the Brahmans in their ceremonies, but who may still be recognised either by their occupation, some of their lingering customs, or a comparative freedom as regards the choice of food stuff. Such are the Koiris, Chamars, Dosadhs and Babbhans.

2. Some of the more important members of this class will be dealt with in more detail. It comprises all the tribes who have remained more or less in the primitive and savage state.

They have continued with their bows and arrows, paganism and superstition. To this class belong the Tharus, Bhuksas, Lepchas, Limbus, etc.

In between these two classes we may place the Bhars, the Kocchs, etc., who are neither totally Hinduised, nor are they pursuing their old course.

It is very difficult to be accurate in dealing with the distribution of any of the aboriginal tribes. Sir H. H. Risley in '*People of India*' says that, "The leading men of an aboriginal tribe, having somehow got on in the world and become independent landed proprietors, manage to enrol themselves in one of the more distinguished castes. They usually set up as Rajputs, their first step being to invite a Brahman priest who invents for them a mythical ancestor, supplies them with a family miracle connected with the locality where the tribe is settled, and discover that they belong to some hitherto unheard-of clan of the great Rajput community . . . till they have been absorbed in the fullest sense of the word, and henceforth pass and are locally accepted as high class Hindus."

It is, therefore, almost impossible for census enumerators to find out the caste of any man, but since we are concerned only with the portion of these aborigines who have not become complete Hindus this difficulty does not stand in our way.

In the descriptive ethnology that follows the influence of these factors may be noticed at every step.

Tharus

The Tharus inhabit the districts of Nainital, Kheri, Gonda, Bahraich, Gorakpur, Champaran, etc. Mr. Nesfield who has given an elaborate account of these people, says, "To the east they extend about as far as the river Kusi, where they come in contact with the Mechs, a tribe similar in habits and features, and inhabiting the portion of the Tarai which separates the plains of Bengal from the hills of Sikkim. To the west they extend as far as the river Sarda. At this they dovetail with another forest tribe similar to themselves in appearance and culture, the Bhuksas."

They claim to be Rajputs having lost their caste by degrading themselves as they indulged in intoxicating liquors, rearing fowls and eating pigs and boars. Crooke has classed them as

Mongolo-Dravidian and accounts for their origin as follows: "The most probable explanation based on the available evidence seems to be that the Tharus are originally Dravidians, who by alliance with Nepalese and other hill races have acquired some degree of Mongolian physiognomy." Risley in the Ethnographic Appendices to the Census of India, 1901 Report, Vol. I, has placed them in the Aryo-Davidian group. From the measurements of cephalic and nasal indices and of stature taken at the census, as well as from the habitat, it seems obvious that the conclusion drawn by Crooke as to the mixture of Mongolian blood in the Tharus to the extent of influencing their physiognomy to a marked degree, is not based on sufficient data. Mr. Nesfield, while writing of the Tharus of Gorakhpore says, "Owing to the intermarriages which have taken place within the last two or three centuries between Tharu men and Nepali women the physiognomy of the Tharu tribe has acquired, in some instances, a slightly Mongolian cast, which shows itself chiefly, but not to a striking degree, in slanting eyes and high cheek bones. In other respects their physical characteristics are of the strictly Indian type. In stature, build, and gait they are distinctly Indian and not Mongolian, nor have they any traditions which connect their origin with Nepal." Crooke has relied too much on the commendable monograph of Mr. Nesfield, quoted above, but has disregarded the fact that it refers only to the Tharus of Gorakhpur and it is not based on accurate scientific measurements.

Tharu marriages are settled by fathers. The father of the youth selects a girl and approaches her father with a present of wine. He makes his proposal for the price to be paid for her, and if the girl's father gives his consent he closes the negotiation by drinking from the present. The average price may be regarded to be Rs. 9 but with the approach of prosperity it is increasing. The Tharus are thoroughly exogamous in the selection of their wives. Child marriage is not very common and the correct age both for the girl and the boy is regarded to be above 17 years. Polygamy, divorce in the form of expulsion from the house of faithless wife with the approval of the council, widow marriage, levirate and exchange of wife in a spirit of mutual accommodation, both permanently as well as temporarily, are all allowed and freely practised.

Burial seems to have been the usual way in which the Tharus formerly disposed of their dead, but due to the influence of Hindu

neighbours, cremation is becoming more and more common except in the case when the death is due to some contagious disease. Immediately after death the corpse is bathed, painted with vermillion and kept outside the village for the whole night. After cremation the ashes are spread in the nearest river.

The religion of the Tharus, who have not been Hinduised, is based essentially on a belief in ghosts and consists of little else. Rev. S. Knowles, whose knowledge of the beliefs of the Tharus is unique, writes in his book, *Gospel in Gonda*, "When the last ray of light leaves the forest and the darkness settles down upon their villages, all the Tharu men, women and children huddle together inside their fast closed huts in mortal dread of these ghostly beings, more savage and cruel than the leopard, tiger and bear that now prowl about for their prey." "They have some idea of a Supreme Being they call Narayan, who gives them sun-shine and rain and harvests, but they have no proper idea how this great, far off Being is to be approached or worshipped."

They live by hunting, and fishing, gathering forest fruits and vegetables, grazing cows and buffaloes, preparing 'ghi,' keeping pigs, fowls, bees and goats and practising a rude form of agriculture.

Rev. Knowles writes "Their chief fishing instruments are the hook and line, the net and the funnel-shaped basket." They used to catch fish by poisoning the water, but have now given up this practice. Their favourite root is a plant of yam species, which grows freely at the foot of the hills. Wild rice, the flower of the 'mahua' tree and the fruit of the wild fig tree are gathered in their several seasons. Until recently they used to cultivate in a rude way by cutting and burning down the jungle, but now they cultivate the transplanted rice throughout the Tarai, and they have a valuable source of food in the plantain which grows plentifully around their villages.

The Census of 1931 tells that they have made some progress in agriculture. In the United Provinces alone, out of 11, 433 male and 1,367 female earners as many as 9,873 males and 844 females are agriculturists; to this must be added the 909 males and 271 females who were returned as field labourers, wood-cutters and those engaged in other allied occupations, and 235 males and 2 females returned as live stock breeders.

"The women do the largest part of the sowing, weeding and harvesting, while the men engage in fishing, hunting, etc., which they regard as the proper occupation for their sex. Their skill as elephant drivers is admitted everywhere and they are often engaged for that service. A number of Tharus work as labourers under the Forest Department as they are expert wood-cutters and not a few are employed in the orange gardens of Butwal, and the digging of 'khas.' The women weave beautiful baskets from 'munj' and other reeds and cane.

"The tools and weapons used by Tharus are not made by themselves. The share of the plough, the point of the spear, the blade of the axe or hatchet, and the blade of hoe with which they dig the yam are all procured from lohars. The curved knife (*Khukhuri*) is procured from Nepal. They work in bamboo, reeds, and fibre and make baskets, snares and nets, and similar appliances for hunting and fishing," but these are mostly meant for their own use.

They make their houses from wood and grass, plastered with red mud outside. The cattle sheds are protected from beasts of prey by strong wooden palings. The houses are large, cool and commodious, and generally raised on poles, in order to protect the inmates from damp and malaria. Dr. Buchanan, in '*Eastern India*' remarks that "the huts of the Tharus have straight ridges, and in general are much wider and longer than those of other natives. On one side of the hut is usually a garden, neatly fenced and containing tobacco, mustard and a few plantain trees."

Every village is a self-governed unit, with a council of administration composed of the elders, presided over by the 'Barwaik,' who has lately adopted the title of Chaudhari under Hindu influence. The selection of the Chaudhari depends upon age, experience and knowledge of magical and medicinal arts. Mr. Nesfield observes that among themselves the Tharus are for the most part a peaceful and good-natured race..

Mr. Crooke describing their food stuffs says, "In Gonda they eat pork, and the flesh of deer and those cloven-footed animals which ordinary Hindus eat, fish, both scaled and scaleless, tortoises, rats and hares. They will not eat beef This is also the case in Gorakhpur In Gonda all Tharus will smoke together They make their principal intoxicating drinks from rice. This rice liquor is drunk more or less

every day, and every member of the family—from the oldest to the youngest—drink it." Rev. Knowles says, "They say by only thus drinking they can be kept alive in these forests, especially in the rains."

The Tharus are making some advance in the matter of education in Nainital district. At the last census some 762 were returned as literate including 19 women; many are 'patwaris' and some are supervisor 'qanungoes.' Till recently one was a Naib-Tahsildar. At the time of the last census one was an Assistant Manager of Co-operative Societies. But they are no more Tharus and have become Brahmanic Hindus.

Some 25,492 were returned in U. P. at the census of 1891 but the number had increased to 31,583 in 1931. They are distributed as follows: Nainital 20,753; Gonda 4,014; Kheri 3,624; Gorakhpur 1,635; Bahraich 1,531; others 26.

In Bihar, the district of Champaran alone accounted for no less than 37,338 in 1931, having increased from 27,620 in 1891.

Bhukṣas

The Bhuksas are much akin to Tharus, with whom they are found mixed in the Tarai and the Bhabar zone from the Pilibhit district on the east to Chandpur on the Ganges on the west. Crooke has divided them into three main sections, the 'Purabi' residing in the east of Ramganga, the 'Pachahami' occupying the Patli Dun and Bijnor between Ramganga and the Ganges, and a section reaching still further west from the Ganges to the Jumna.

The origin of the word Bhuksa is not known and as to the origin of the tribe only this much can be said that they belong to the Aryo-Dravidian type. In *Ain-i-Akbari* they are mentioned as occupying the Tarai areas.

Dr. Stewart in *The Journal of Asiatic Society of Bengal*, Vol. XXXIV, describes them in Bijnor: "The members of the tribe are of short stature and very sparse in habits Their eyes are small, the opening of the eye-lid being narrow, linear and horizontal; the face is very broad across the cheek bones, and the nose is depressed, thus increasing the general flatness of the face."

Sir H. M. Elliot describes them as having fifteen septs ('Gotras') of which twelve are superior and three of inferior rank.

Bhuksas are exogamous and cannot marry in their own sect. Marriage consists of three different parts, the 'Magni,' the 'ganana' and the wedding. In 'magni' the parents of the girl take the lead and send a rupee, one piece of 'haldi', a twig of 'dub' grass, and a piece of charcoal to the boy's house through a Brahman and a Nai. The 'ganana' is for the Brahman to bargain with both the parties for the selection of an auspicious day to which they have got to agree. The wedding is preceded by four feasts in both the families and followed by a fifth at the house of the bridegroom.

Widow re-marriage—'kaj' or 'karao'—is permitted, and divorced women may also marry. They may marry as many wives as they like but two is the usual limit. Boys are generally married at the age of twelve. If the marriage be subsequently annulled and the girl marries again, her second husband has to refund the expenses of the first marriage.

Bhuksas usually cremate their dead, but those dying of burning, drowning, snake-bite or some contagious disease are buried. "Before cremation two balls of kneaded flour covered with turmeric are placed on the chests of the deceased. The body is wrapped in a white, unwashed cloth, and as in the case of Tharus, is usually burnt (or buried) to the west or south of the village, though they can give no reason for this." The Mahra-Bhuksas found inhabiting the most unhealthy parts in eastern Dun are very particular in cremating on the bank of Ganges or at least depositing the ashes in the sacred river. For thirteen days after the death they give a cake to the cow before themselves taking anything and on that day they are purified by giving 'dan' to the Brahmans.

They worship several 'debis' and 'deotas', but the greatest of all is supposed to be at Kashipur. Crooke mentions that some are Sikhs, but probably they have again passed into paganism or have become true 'akalis' as the last census report does not mention their presence. They pay special devotion to Bhavani—the goddess of death.

As in all other branches of religion, customs, social status, etc., the houses of the Bhuksas are very similar to those of Tharus in structure and are kept equally clean.

Of their villages in Bijnor, Dr. Stewart says: "All are built on the same plan of one straight street, generally of con-

siderable width. The huts are placed end to end the walls are, for the most part, built of wattle and dab, but sometimes of thatch The houses are windowless but each has a door and another behind," where the cattle sheds are situated. The doorways and roofs are very low while the floor is raised higher.

At the census of 1891 they returned themselves as Panwar Rajputs but changed their caste name wholly in forty years, becoming Brahmanic Hindus at the census of 1931. It may be this change or some other factor which caused a great error at the census of 1891 when only 1,907 were recorded in the Province, as against 5,664 in 1881 and 7,618 in 1931. They have thus recorded an increase of 34.5% in fifty years. Mr. Colvin was obviously mistaken when he remarked that "they are slowly but certainly dying out," since they have increased from census to census.

Bhuksas are very backward in education, more so than the Tharus. In 1931 only 23 males were returned as literates and no females.

Bhars

The Bhar tribe has neither been so much Hinduised as the Koiris or Chamars nor has it remained in a wholly primitive state like the two mentioned above and so they do not deserve a detailed description.

They are distributed all over the Province with great concentration in the east, right from Mirzapur in the south to Gorakhpur in the north and Fyzabad in the west.

Bhars have the usual rules of exogamy. Widow re-marriage is permitted. A girl above ten years of age is known as 'rajaswali', and it is a disgrace not to have her married.

In physical traits it is difficult to distinguish them from the low caste Hindus with whom they have freely mixed.

The dead except those who are unmarried, or those dying of cholera, and small-pox, are cremated. The others are buried or their corpse thrown into running water. The dead pollution lasts for ten days, during which time the chief mourner lays out a little food for the ghost.

Their tribal deities are Agwan Deva, Phulmati, Bhawani, the Panchopir and Banru Bir, a deified ghost.

The women are tatooed on the arm. The Bhars will not touch a Dhobi, Hela, Dom, or Dharkar, nor the wife of the senior brother-in-law, nor the younger's wife.

They are usually employed as day labourers and plough-men. They keep bees, pigs, goats and cows. They are keen sportsmen, untiring in pursuit, and excellent shots with guns, while the hatchet is their constant companion. Everywhere they have settled down in villages, acquired land and form very good agriculturists.

In the Tarai districts of the Province they numbered as many as 107,794 in 1891, while in the Province they totalled 417,745 at that time.

This great race had once ruled the districts in which they are at present principally found, and have left several mud forts as remnants.

Having so far dealt with the people who passed into the Tarai Region from the plain area to the south, we will now pass on to the people who have migrated from the hilly regions and are occupying the northern part of Bengal. They have, for centuries, lived under altogether different environmental conditions, and we must review the geographical factors which have not only influenced but built their culture.

"Every mountain slope" as Semple has said, "from summit to piedmont is, from the anthropological standpoint, a complex phenomenon. When high enough, it may show a graded series of contrasted complementary location, closely inter-dependent grouping of populations and employments, every degree of density from congestion to vacancy, every range of cultural development from industrialism to nomadism."

They have got to adopt terrace agriculture in the narrow valleys to support the growing population, and this needs special care, special implements and special treatment, with heavy fertilizers especially as the rainfall is very great and liable to wash away the thin soil.

Paucity of arable land in mountain regions leads to the utilization of the un-tillable slopes for stock grazing, and sheep are always maintained to supply manure, wool and skins as well as to add to the food supply and serve as beasts of burden when they migrate.

"To have and to hold" is the motto of all the hill tribes. The mountains are often museums of social antiquities, and these characteristics are amply illustrated by the tribes dealt below.

Lepchas

The Lepcha is of truly Mongolian origin and has only lately come into British India. They are found in western Butan, eastern Nepal, Sikkim, Darjeeling and Jalpaiguri.

"They are of short stature averaging about five feet. The face is broad and flat, nose depressed, eye oblique, no beard, but a little moustache, complexion olive." It is often difficult to recognise the males with no beard, long plaited hair and with clothes very similar to those of the females. "They are proud of their hair and careful in its arrangement, the women wearing theirs in two tails tied with silken cords." They are well clad with clothes, as might be expected. The cloth is often coarse and flossy silk woven from the 'eri' of Assam. Over this they have a sleeveless woollen overall, fastened by a girdle of silver chains.

They do not marry young. Huge sums are demanded by the parents of the girl. Sometimes marriages take place on credit when the boy goes over to reside with his father-in-law till he has paid the amount settled, and only then he is allowed to take the wife away.

They either bury or cremate their dead, according as the dead is a Buddhist, a Christian or a Hindu.

Dr. Campbell says, "They are amiable and cheerful in disposition and of an intelligent and inquiring turn of mind which renders them attractive to European." Col. Walter Sherwill calls them, "the free, happy, laughing, and playful, no-caste Lepchas, the children of mountains, modest, social, and joyous in disposition." They are fond of racing, playing at hop-step and jump, wrestling and jumping. They are great practical jokers, but are usually dull and lazy at work.

From the point of view of religion the Lepchas can be divided into four different groups, Hindus, Buddhists, Christians and Animists. Their priests wear Buddhist garment, follow the Buddhist prayer machine, and like them profess monkish medicine, are exorcists and the directors of feasts, ceremonies and sacrifices in honour of evil spirits. For centuries they have been

so much under the influence of that religion that, as Dr. Latham states "whilst flirting with the mysteries of that religion they retain much of their original paganism or Sahmanism."

The Buddhist Lepchas have priests, some of their own tribe educated at home, a few of the same race who go for their education to the great monastic establishments beyond the snow, and some Tibetan priests.

They are poor agriculturists. Nomadic in their habits, they form no permanent village, and cultivate barley sufficient for their subsistence. They collect wild fruits, roots, fern tops and fungi and are very good hunters. Very like all the hill tribes they have no ploughs and with their rude implements are able only to scrape the ground upto a few inches in depth. This is probably more beneficial than harmful in their environments and climate.

They keep small herds of cows, goats and sheep, which graze under the supervision of the children. They are fond of milk and the females weave a very coarse cloth from the sheep's wool, or they exchange it for other requirements. When abandoning a village site their cows and bulls serve them as beasts of burden.

The Lepchas are not a warlike race. They carry weapons such as a long knife and bow and arrows, but are fonder of using them against wild beasts than against men.

They are not very prohibitive in the selection of their food stuff. Pork is their favourite dish, and beef, goat and mutton are all taken. Some of the Hindu Lepchas avoid beef. They are fond of fermented and spirituous liquors, but are not much given to excess. They make themselves a beer from a fermented infusion of Indian corn and 'murwa', which is very refreshing.

15,479 Lepchas were enumerated at the census of 1891; they increased at the census of 1901, but at the two following censuses they recorded a heavy decrease, which had been more than compensated at the time of the last census when some 25,161 were registered, of which 23,038 were Buddhists, 1,949 Christians, and the rest Hindus or animists. It is rather difficult to account for the increase of over 34% during the last decade except by migration to the tea gardens. They have lately come into disfavour at these gardens and are retiring to their home across the border.

It is very interesting to note, but rather difficult to explain, the almost complete absence of females amongst the Hindu Lepchas, who have returned only 8 women in a total of 214. On the other hand amongst the Christians, there is a fair majority of the fair sex. Females are again more numerous amongst the Buddhists Lepchas of Bengal.

Limbus

The Limbus are a branch of the people called 'Kirantis' or 'Kirati.' They are probably of Mongolian descent, and have been mentioned in the *Vishnu Purana*.

The Limbus, according to Dr. Campbell, "form a portion of the inhabitants in the mountainous country lying between the Dud-Kosi and the Kanki rivers in Nepal. They exist within the Sikkim territory, as far as the Tista river, beyond which they rarely settle."

Dr. Campbell (J.A.S., 1840) compares them with Lepchas in the following words: "The Limbu is a little taller in stature than the Lepcha, somewhat less fleshy, and more wiry in limbs, as fair in complexion, and as completely beardless. He is scarcely as ruddy as the Lepchas sometimes are; his eyes, if anything, smaller, and placed more to the front than the Lepcha's and his nose, although somewhat smaller, is rather higher in the bridge than that of the Lepchas. He wears his hair long, but does not plait it into a tail; has no fancy for bead necklaces; wears a 'Kukri' instead of the 'ban'; and wide trousers and a jacket or 'chapkan' in preference to the robe and long jacket of Lepchas."

They may call themselves Hindus, Buddhists or Christians but they are essentially pagans. Mr. Hodgson found that they had no name for God, and no recognised order of priests. They worship a host of spiritual beings whose attributes even are not very well defined. They do not build temples, or make images of these gods, but propitiate them by the sacrifice of buffaloes, pigs or fowls, only when need occurs. On these occasions the persons employed as priests are either Bijowas or Phedangkos. Bijowas are a very interesting class of mendicant friars, "who by cunning and charlatanism inspire their votaries with considerable awe, but who are ready for a consideration to sing or dance for those in health, prescribe for those who are sick, and cast the evil out of those who are vexed." The Phedangko is more exclusively

the Limbu priest. He officiates at sacrifices, marriages and funerals. After the birth he foretells the destiny of the infant, and invokes the blessings of the gods, by sacrificing a fowl or a kid.

The Limbus purchase their wives by money or labour. The men select for themselves and then send a present of a couple of rupees through friends who negotiate for the price or other preliminaries. On the day fixed for the ceremony, the bride and the bridegroom are seated side by side and the priest admonishes them. "He then gives a hen into the hand of the bride and a cock into the hand of the bridegroom and cuts off the cock's head first and then the hen's; their blood is allowed to mingle and auguries as to the prospects of the happy pair drawn from the form it assumes as it flows."

Both cremation and burial are in vogue amongst the Limbus, the latter being the more common. Cremation is carried out on the summit of a mountain and the ashes are collected and buried in a grave, over which they raise a square tomb of stone, about 4 feet high, placing an upright stone on its summit. On this stone they engrave a record of the quality of largess distributed at the funeral of the deceased, in Devanagri or Lepcha character. In the case of burial the corpse is placed lying on its back with the head to the east. "The grave is lined with stones, and a cairn, consisting of four tiers for a man and three for a woman, erected on the top. The Phedangko attends at the funeral and delivers a brief address to the departed soul on the general lot of mankind and the doom of birth and death, concluding with the command to go whither his fathers have gone and not to come back to trouble the living with dreams." A rupee in a brass plate is occasionally placed under the head in the grave. Mourning is expressed for a month by a white rag tied round the head.

They possess plough but do not use them in the small terraced fields. Hodgson remarks, "Their general almost exclusive status is however agriculturist, they produce maize, buckwheat, millet, dry rice and occasionally cotton. They have no craftsmen." The Kirantis, however, spin, weave, and dye clothes for their own use, and make fermented and distilled liquors.

"In the matter of food they have very few prejudices. They eat beef, pork and the flesh of all the clean feeding animals, and drink wine." They keep fowls, pigeons, herds of cows and buffaloes.

Only at the census of 1921 they showed a decrease, which might have been due, at least in part, to the great influenza epidemic of 1918. In spite of this they have increased from 17,386 in 1891 to 27,889 in 1931. Of these 17,860 were returned as Hindus and 9,969 as animists. The decrease of the Hindus by 4,783 at the last census and the increase of the animists, much at their cost, illustrates fully the statement of Col. Dalton who describes their religion as follows. "The Limbus or Kirantis, though subjected to the sneers and frown of a Brahmanical priesthood on one side and the more indulgent exhortations of Buddhist monks on the other, have, like the Kols, obstinately adhered to their primitive paganism." It cannot be said how far the queer system of the voluntary conversion of Murmis, Lepchas, and Butias by the approval of the council and on a declaration at a feast, has been responsible for this great increase. Khambus, Jimdars and Yakhas, being Kirantis themselves, are allowed to enter the folds of the tribe, without the permission of the council.

Mechs and Khambus

All the authorities agree in considering Mech, Khambus and Kachari as the same people, or at least of common origin. The name is almost certainly a corruption of the Sanskrit word 'Mleccha.'

The Mech are to be found in the Bhutan duars. From thence they extend in a westerly direction up to the Kanki river in Nepal Tarai. They are fairer than their neighbours, the Kocchs, and have more markedly the Mongolian characteristics, "but accompanied by softness of outline which distinguishes them readily from the more marked features of the same order, as exhibited in the Lepchas, Limbus, and Butias. They are said also to resemble the Mugs and Burmese."

They are definitely animistic in religion, based characteristically on dread and fear. They worship their ancestors, natural forces and about nineteen gods of household and village importance. They have no priests and all religious offices are discharged by 'Deoris', who are usually men of a certain age and recognised. They worship the 'Siju' tree as the emblem of supreme deity.

Marriage by capture was largely, if not universally in vogue among the Mech in earlier days, but now a contract is entered into. As among the Lepchas and the Limbus the bride prie

is to be paid either in cash or in labour by the bridegroom, but the girl does not leave her home till she has attained a suitable age. On the marriage day the bridegroom generally does not accompany the marriage party to the house of the bride, where her people pour freely on the whole party an irritating liquid known as 'Kachu pani' and to this somewhat rough welcome the bridegroom's party are bound to submit without complaining, although the liquid causes much irritation to, and even blisters, the skin. The party then hands over the presents and is then served with meals by the bride herself. All expenses attending the marriage are borne by the family of the bridegroom, the bride's people, as a rule, contributing nothing. Drinking, merrymaking and dances are a feature of these marriages.

The dead are disposed of either by burial or by cremation. The latter is looked upon as more correct and respectable, though the former is more common for reasons of economy. In the case of well-to-do people a certain number of rupees are usually buried with the corpse, and even the poorer classes make offerings of pice, etc. In the case of cremation after placing the body on the funeral pile, the deceased's friends and relatives pass round it in procession. The ashes are not carried away.

Agriculture is the great industry of the Mechs and the Kacharis, both the hot weather and the cold season varieties of rice being largely cultivated. In carrying out this work the people show both application and skill. They are specially skilful in the construction of irrigation canals and earthwork embankments; and their efforts in this direction are very largely aided by their clannish organisation. Pulses, tobacco and occasionally a little sugarcane are also grown. They weave fabrics of 'muga' and 'endi' silk.

With the exception of beef the Mech denies himself almost nothing. His great delicacy is pork, and a Kachari village usually swarms with pigs. "There is, however"; as stated by Rev. S. Endle, "one common article of food, which no orthodox old-fashioned Kachari (or Mech) will ever touch, i.e., milk."

Mechs have been recorded almost exclusively in the Jalpaiguri districts, where they total 9,503, having decreased very gradually from a total of 22,350 in 1901. Of these 9,503 only 2,528 were classed as animists and as many Christians. The advance of settled cultivation is driving these shy people from Bengal into the less developed parts across the border in Assam.

Bhutias

The Bhutias represent a complicated mixture of tribes from Bhutan, Nepal, Sikkim and Tibet.

Their history is shrouded in mystery, but between 300 and 400 years ago they had several conflicts with Kocchs whom they forced to submit.

"Physically the Bhutias are a very fine people, there are some really tall men amongst them, but though very robust as compared with the people of the plains, they are not nearly such a stalwart race as Sikkimese, and Tibetans, which is possibly to be attributed to their immorality and drunkenness." . . . "They have all broad flat faces of the true Mongolian type, small oblique eyes, large mouths, noses short and low, not, on the whole, the most attractive combination of features; but many of the young women have fine plump rosy cheeks, healthy and pleasant to look upon, though their complexion, a light olive, has nothing in common with the lily. They appear rather careless about their personal appearance. Many women appear with shorn heads. There are nuns who are said to have taken vows of celibacy. As a rule they are dirty in their persons, wearing their clothes till they rot off, and seldom indulge in ablutions."

They wear a loose woollen coat reaching to the knees, bound round the waist by a thick fold of cotton cloth. The full front of the coat forms a huge pocket, and "into this opossum-like pouch, food cooked and uncooked is often thrust, including fish and meat, and as one side of it is the naked skin of the owner, the nastiness of the arrangement may be conceived." The women wear a long cloak with loose sleeves.

The predominance of the Buddhists is so great among them that the negligible proportion of the Hindus, Christians and animists does not matter in the consideration of their religion. The Ghylongs, Lamas or priests form a very large proportion of the population. The office is often not hereditary and any one can be admitted to the priesthood on payment of a fee to the Deb, or the Rajah. The Lamas are also charged with the medical care of the people. They wear dresses of a garnet colour, a woollen garment thrown over the left shoulder leaving the right arm bare. They live in big monasteries and preach that the soul of the religion is mental abstraction. They may call themselves Buddhists but they are still pagans in the true sense of the word, believing

in a host of spirits and making offerings of flowers, rags, rice and pulses before them.

Marriages are not very binding and chastity is neither practised nor appraised. Polyandry is a recognised institution amongst them, and the practice increases as we go to the north. Its origin is clearly traceable to Tibet, and Pemberton adds that, "Political ambition is the main cause of so revolting a practice, as all aspirants for office are compelled to renounce the happiness of domestic life." There is no law of inheritance, as the dead man's property goes to the Deb or Dharma.

In the disposal of their dead the Bhutias follow the practice of Hindus. They cremate the dead and throw the ashes into the nearest stream.

In the construction of houses the Bhutias are rather in advance of their neighbours of the plains. Their buildings are of rubble stone and clay and occasionally go up to four stories. The varandahs are neatly ornamented with carved and painted wood. Mr. A. Eden reports that they display considerable architectural and constructive skill in building embankments and bridges.

It is only the coarser description of cloths worn by the Bhutias that are woven in the country; their silken dresses and finer woollen fabrics are obtained from outside. The work of weaving falls to the lot of women. They have acquired the art of paper-making from the bark of 'diah' tree and have their history written. They have learnt the art of distillation and prepare their drinks from wheat, rice and millet. Many of them are engaged as carpenters and wood-carvers in several big towns of Bengal. They also keep goats, sheep and cows. Terraced agriculture is followed on the hilly sides.

They are very fond of horse racing. The function is rather an exhibition of the skill and dexterity of the rider, and no attempt is made to test the speed of the horse. The riders are practically naked, but the horses, though without saddle, are well decorated.

Their number in the British Territory is fluctuating from census to census. At the time of enumeration, it seems that a little mistake transfers a considerable number from one column to another, as their homelands are also recorded. In 1931 they totalled 29,454 having increased from 27,287 in 1921 and 17,676 in 1891. The Bhutias of Sikkim and Nepal contribute the main propor-

tion of the total number of Bhutias recorded, though in British India they hail mainly from Nepal.

Koch or Kocch

The Kocchs as the Bhars described above, are the remnants of a great race. They have like the Bhars, become comparatively civilized and so only deserve a passing reference. The Cooch Behar State is the nucleus of their once great kingdom. They are distributed throughout the Province and many of them have entered the folds of Islam.

Their women really form the better half. When a woman dies, the family property is divided amongst her daughters; and when a man marries, he goes over to live with his wife's mother. Marriages are settled by the mothers when the parties are young, but the girl may change her mind and select her own husband when she grows.

"The dead are kept two days, during which time the family laments, and the kindred and neighbours assemble, eat, drink, dance, sing and make merry; the body is then carried to the side of the river and buried.

Rishi is their supreme deity. At the end of the rainy season a grand sacrifice is made to the deities by the whole tribe. They also sacrifice to the sun, moon, stars, and to the gods of woods and rivers. When they collect the first crop, they offer some of the first fruits to their ancestors.

Living in the plains for a long time they have become very good farmers and cultivate rice, jute and tobacco.

In the Tarai districts the Hindu Kocchs total 15,047 out of a total of 81,299 in the Province. Cooch Behar accounts for 1,230 only.

With these tribes ends the list of communities which have been selected as representative of the different elements of which the vast and complicated society of these varied people is composed. What all this brings home is that a tribesman of the Tarai Region is "essentially conservative. There is little in his environment to stimulate him to change, and little reaches him from outside world." He is strangely indifferent to what his fellow beings are doing a few yards away from him. With his conservatism is "coupled suspicion towards strangers, extreme sensitiveness to criticism, superstition, strong religious feeling, and an intense love for home and family." While these forces are acting against him, there is little hope of his rapid progress.

Extracts from Periodicals

CLASSWORK AND HOMEWORK IN GEOGRAPHY

By

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There is probably no subject which offers a greater variety of opportunities for pupil activity than Geography. Thus there is no excuse for the teacher who allows his classes to fall into a monotonous routine of copying maps and learning notes as their share of the business of learning geography. Pupil activity is a term which obviously includes the work done by pupils during the course of the lesson, or before it, or after it. In other words it includes class work and home work, group work and individual work. Before describing a few of the almost unlimited possibilities for pupils to work in the geography class or at home, it may be worth while to examine the aims and values of setting work for our pupils.

It is an established fact that we all, teachers and pupils, parents and children "learn by doing" or in other words that learning is an active process. Teachers cannot teach: they can only help their pupils to learn. Consequently the work which our pupils do is far more important in their education than anything we teachers can do for them. And work which they do with interest and enthusiasm is far more valuable and lasting than work done because it must be done.

In teaching geography we are trying to help children learn certain important geographical facts and relationships. These may be explained, or pointed out on a map, deduced or discovered, by the teacher and pupils working together in various ways using various kinds of equipment. Often pupil activity either in the class or at home may be in preparation for this co-operative endeavour in the class-room. The term 'Prep' so commonly used in England emphasizes this aspect of home work. The preparatory type of home work may be purely mechanical including such things as preparing a series of sketch maps to be filled up in class; or it may be a truly creative piece of work, a problem solved, a discovery made, a principle grasped for the first time.

On the other hand, the pupil's work often may be a continuation of the work done by teacher and pupil together in the class period; for example the completion of a map began under the teacher's guidance and finished alone, the necessary revision of notes, the reading of a supplementary book. Again pupil activity may be in the form of practice or repetition of the facts and relationships presented and comprehended in the class period. The necessity for drill, the repetition necessary to fix and retain material learned is obvious. There is therefore a legitimate place for drill in geography teaching and there are so many ways of drilling that the drudgery sometimes implied in the term may be minimised by the interest and variety of the methods employed. Again in teaching geography we are trying to help our pupils learn to use the 'tools' of the subject, maps, graphs, diagrams, instruments, and to learn to use them easily and independently. Therefore there must be time for pupils to work with these tools. They should learn to make and read maps, graphs and diagrams quickly and accurately.

The pupils' work whether in the Geography period or at home, should not be thought of as something separate and different from the teaching. One supplements and completes the other. Both are parts of the integral whole which is learning geography. There should never be the feeling that one kind of work is suitable for home work, another for class work and a third for the teacher; that this piece of learning is always to be undertaken by the pupil and that is always to be presented by the teacher. The whole process is (or should be) related; one part leading up to and preparing for the next, all equally valuable and as necessary to each other as the links of a chain. Let us never think of homework as 'busy work,' just something to keep the children occupied in their study hours. Let us never think of class activity as merely a pleasant change from listening to the teacher, necessary as recess is necessary. No, the teaching-learning process is a cycle. Home work leads us to and prepares for the class period. The class period may include both teacher's work and pupil activity and should culminate in the assignment of the next piece of homework.

Any discussion of the kinds of pupil activity must necessarily be incomplete. But perhaps a brief description of certain types of work may be suggestive to the enterprising teacher.

Map work is probably the commonest form of geography homework and class-work, and rightly so. It may often be done to help children acquire facility in the use of this tool; both as a

means of expression of geographical facts and as a source of geographical information. The chief aim in this type of map work is to make children familiar with the symbols used on maps and to enable them to understand the reality behind the symbols. Therefore it is often a good plan to let children invent their own symbols, pictorial or colours, or shading. Encourage the pupils to make maps which are different from the rest of the maps in the class which show the same things. Of course care must be taken to keep the commonest conventions but there is scope for much inventiveness in the use of symbols. If a map the teacher has drawn is to be copied, suggest that it should be expressed by different symbols. Making new maps, using either verbal information or statistics is an extremely valuable exercise. Suppose the text book says "sheep are found in large numbers in the Canterbury plain," the pupils can be asked to locate the plain on their outline maps, and to write the word SHEEP in several places. This of course results in a rough and approximate map. At a later stage the use of figures and their conversion into dots or shades of colour on the map may be taught and more exact results obtained.

Using map work for drill is another popular exercise and again rightly so. But the exact copying of any map should generally be avoided. If the textbook and atlas do not contain a map with certain necessary facts, the teacher is then justified in asking his pupils to copy a really valuable map. But in most cases the pupils should be directed to select certain facts from the maps they have, and put them on a new map. The selection of a few rivers with only their main tributaries is far more valuable than drawing all the rivers shown in the atlas. An economic map may be separated into several maps. For instance a map may show the distribution of the minerals of India. Let the pupils make a number of small maps, each showing one mineral. This process of selection fastens the attention of the pupils on the important facts which must be learnt, and the simplicity and clearness of the resulting maps serve to emphasize the facts which must be remembered.

Another interesting map exercise is the reverse of the one just described. Two maps from the atlas or text book may be combined and a new map produced. Often valuable relationships may be discovered by doing this. One method is to have a map showing, let us say the distribution of rice in India drawn on transparent paper. This may be superimposed on the rainfall map, the relief map and the population map. Then when the

pupils have seen the relationship between the 40 in. rainfall line and the distribution of rice, a map showing both should be drawn. Other maps which may be usefully combined are summer and winter temperature maps, summer and winter rainfall maps, and almost any crop distribution with its climatic or relief controls. Population maps are full of possibilities for this sort of map-correlation.

From what has been said it is apparent that the filling up of the map is of greater importance than the drawing of the outline. Teachers should make every effort to supply their pupils with outline maps. The exception to this of course is in the use of sketch maps. On a sketch map, the pupil or teacher is expressing in a generalised and approximate form a few salient points to be remembered. The use of the sketch map as a form of geographical shorthand and as a means of summarising a lesson should be encouraged in every possible way. Let us emphasize especially the fact that skill in drawing is not essential for the making of a sketch map. A glance at any of the sketch map geographies or atlases now available should reassure diffident pupils on this point.

The use of diagrams, climatic and economic is an important part of geography teaching. Rainfall and temperature figures may be used, graphs made and studied. The climate graphs found in textbooks should be interpreted. The same principles applies to the making and interpreting of economic diagrams. The best modern textbooks all give statistics which can be converted into diagrams. The easiest form of diagram is the horizontal bar, but very nearly as easy to make is the pillar or vertical column diagram. The circular diagrams is more difficult but with a little help from the mathematics teacher and some reference to the standard of mathematical achievement of the class, the circular diagram may provide a very interesting exercise.

Simpler than converting figures into diagram is to change the form of the diagrams. A bar may be changed into column or vice-versa. A circular diagram may be changed into either the bar or the columns. All diagrams should be read. It is quite useful to "translate" a diagram into a paragraph. For instance a diagram showing the exports and imports of a country would furnish material for an interesting paragraph on the trade of that country.

The guided use of the text book is another excellent activity for our pupils. A series of questions may be prepared so that the

answers when written in sequence provide a concise summary of the chapter. Or a summary may be prepared with important words omitted. The pupils on reading the book will fill up the blanks. This sort of exercise should help pupils to read their textbooks intelligently instead of memorising them word for word. Encourage the pupils to make summaries or outlines of what they read. Give tabulated headings which may be filled up after the reading of the book.

Another interesting exercise involving the use of textbook is to ask the pupils to frame questions on the chapter to be read, which they may ask their class-mates. A correct answer to a neighbour's question (judged by the questioner rather than the teacher who will only intervene if the questioner is wrong) means an opportunity to ask a question of another neighbour. It is not possible to get a connected series of questions in this way but in spite of that it is a good exercise and stimulates careful reading and remembering of what has been read. Actually a small group of intelligent pupils will be able to frame a connected series of questions on the text-book or on the atlas. Once in a while let four or five of best pupils "teach" the rest of the class! The result will be surprisingly good.

As a change from the rather precise type of exercises already described, it may be useful and interesting to suggest an imaginative essay based on geographical knowledge. It is perhaps most useful as an incentive to revision after the study of a continent. "A journey on the Trans-Siberian Railway" or "Along the coast of Africa," or "Up the Nile" or equally interesting are "life stories," "My life" by a tin of apricot jam, "My Career" by a red woollen blanket. Further types of essays are imaginary conversations, with a cowboy of the Prairies, with a guacha of the Pampas, with a miner in Australia.

One type of pupil activity which can only be mentioned in passing is the making of models, generally showing relief of rivers. This is a topic which needs more detailed explanation than can be given in this article. But it is a valuable form of work, and it may be done with less effort and in less time if damp sand (not mud) is used as the modelling material instead of paper pulp or clay. Finally the possibilities of using pictures as a basis for pupil's work should not be overlooked. Questions about the pictures, verbal descriptions of a picture and various other activities may be planned.

MAP STUDY OF CURRENT NEWS

How They Do It in an English School

One serious problem to-day is the interpretation of current events for our pupils. Children, even the younger ones, see the newspapers, listen to the wireless and overhear much conversation that is confusing and often alarming. The school must make an even greater effort than usual to clarify the news and give much-needed guidance on world affairs, writes a correspondent in the *Times Educational Supplement*.

The majority of schools work, in some form or another, through regional geography schemes. Such schemes can be modified so as to include current events and to give a helpful background for the explanation of day-to-day happenings all over the world. In addition to the valuable guidance for the pupils this will be found to have a good effect on the general "reality" of the lessons.

An ideal scheme involves the close co-operation of the history and geography specialists, so that the geographical factors and the historical interpretation are both given full value. One school has made use of such a scheme for the past few years with excellent results.

Throughout the school a certain amount of time was definitely allotted in each geography lesson for comment on current events. It was found most convenient to use 10 or 15 minutes, or a shorter period, according to age or the amount of "front-page news" available, at the beginning of each lesson. If at all possible, the event commented on was of particular value to the class in view of the part of the regional scheme reached. For example, if the class were at a point where they were paying particular attention to the Arctic or sub-Arctic region, and there happened to be some news of those parts, then that was the news most concentrated on. This does not mean that the pupils were led to suppose that such a piece of news was more important than any other, but they were told how it held particular interest for them by reason of the work they had already started.

In addition to this brief commentary each class had a special "news lesson" every week. A similar one was given by the history specialist, after the geography one, as it was found more helpful in that order. Such lessons were illustrated by means of the large globe, very large regional maps, and the pupils used individual atlases for further detail. Illustrations from magazines and newspapers were pinned up and passed round. Every effort

was made to help the children to visualise the actual territory, to "see through the map" and to realise the significance of geographical factors on the daily life of the world.

In a large lobby, through which all pupils passed several times a day, and where they assembled for "elevenses", we had two big notice boards, one of which held a large regional map of the world, the other news cuttings. Pupils with a suitable member of the staff to give help if needed, were in charge of these, taking it in turn to read the newspapers each day and pin up important cuttings, with occasional comments pinned below to clarify matters. The map was equipped with various pin-on flags and signals, cutouts for ships, made by the pupils in their individual work periods, and notices for such physical phenomena as volcanic activity, earthquakes, tidal waves, hurricanes, extreme frost, and so on.

It was the business of the pupils in charge of the map to see that the various pin-on flags were moved correctly each day before 11 o'clock. As the school time-table allowed for a good deal of individual study during the first few hours, there was plenty of time to get information from the pupils in charge of the newspapers. When any news of exceptional importance occurred a special large red flag was pinned on the spot on the map, while a brief comment was written and pinned in the margin of the notice board.

In addition to world news, which does, of course, need most emphasis and comment, the children were always encouraged to notice and comment on more local events that had a geographical basis. For instance, a severe frost would have important effects on the local fruit growing industry, or a gale, noticed by its fury in the school vegetable garden, would probably cause the local lifeboat to be active. Local papers were studied once a week and cuttings put up on a special section of the board, with comments by any pupils who had made special observations at the actual time of the occurrences.

Too few adults have any conception of exactly where events are happening, and though the various maps, published from time to time in the papers, are of some help they are always too limited an area to give real clues to the importance of neighbouring States or to indicate what repercussions any event may have. Soundly taught regional geography, it has been shown by this scheme, can give the guidance needed for understanding current events.

News and Notes

The Presidential Address of Mr. M. Subramania Iyer, B.A., B.L., at the 11th Geographical Conference held at the Rishi Valley in May last, has for theme a reasoned Defence of Modern Geography and a Comprehensive Introduction to it; and gives also a brief account of the steps taken to establish it in Madras. The Address is published in this issue as the main article. Some of the remaining papers of that Conference will be included in the next issue.

* * * * *

In the July meeting of the Association, held on 19—7—'41, Mr. N. Subrahmanyam explained the plan and principles of the new elementary school syllabus in Geography, recently issued by the Madras Educational Department—the first modern one, which has taken a dozen years to filter down from the high school. A vigorous discussion followed, regarding the possibility and ease of covering the syllabus within the time.

* * * * *

A Refresher Course to explain and elucidate the methods of handling the subject at the stage and according to the syllabus, and Children's Books prepared in the mother-tongue in accordance with it are two immediate needs. And in preparing books in the mother-tongue, two difficulties have to be got over—the first is that of finding proper equivalents for the technical terms, and the second is the correct pronunciation and therefore the correct spelling of place-names.

* * * * *

In the August meeting of the Association, held on 9—8—'41, Mr. S. Muthukrishna Iyer gave a talk to teachers on *Assignments in Geography for Forms I to III*. Speaking on the kinds of practical work that should be done in those classes, he put special emphasis on local observations of the sun's altitude, weather, etc., and explained in detail the methods of recording and utilising the records.

* * * * *

The Indo-Brahm River.—Messrs. M. S. Krishnan and N. K. N. Aiyengar have, in the *Records* of the Geological Survey of India, Vol. 75, July 1940, discussed the problem whether the Indo-Brahm or Siwalik River ever existed. On the southern side of

the Himalaya, in the Indo-Gangetic plains, there is a thick series of Middle and Upper Tertiary deposits, known as the Murree Series (Lower to Middle Miocene) and the Siwalik (Upper Miocene to Lower Pleistocene).

* * * * *

* * * Pilgrim and Pascoe argued that the Siwaliks were laid down by one great river flowing from Assam to the Punjab, and thence to the Arabian Sea, and that this river was later dismembered by a process of capture. The present authors question this view, and suggest that it is unreasonable to suppose that the great masses of the Siwalik deposits were laid down by any such river. They argue that it is much more probable that these beds were deposited in a fore-deep. * * * * The Boulder conglomerate which forms a fairly constant horizon at the top of the Siwaliks is regarded as being due to the combined action of streams draining from the mountains directly on to the plains, helped in part by recent geological uplifts and special flood conditions.—J.A.S. in GJ.

* * * * *

Sometime ago we read of a vast field of gypsum, situated between Sulurpet and Pulicat Lake. Now, the Geological Survey of India mentions in a Bulletin on Economic Minerals about the existence of phosphates within a depth of 200 feet in Trichinopoly District, Madras and in the Singhbhum District, Bihar. Phosphorus-bearing minerals are of particular importance to agriculture, since the element is an essential constituent of plant food. Phosphorus finds application in smoke-screens, incendiary shells, tracer bullets, grenades, fire-works, medicine and vermin-destroying pastes, while the acids and salts of phosphorous find extensive use in various industries. India is a fairly important importer of fertiliser materials, including super-phosphate and ammonium phosphate, though there is considerable scope for the expansion of the manufacture of phosphates. This is a matter which ought to receive the earnest consideration of the Government and industrialists alike.

* * * * *

War and Geography.—The War has been expanding and widening in new areas and directions, helped and hindered by Geography. We referred in the last issue to the quickening of industrial activity in India as a result of the War; and though there has been the closing of certain markets, commerce with the U.S.A., has been considerably on the increase, as pointed out in *The Indian Information*.

* * * * *

"These are the trump-cards in the hands of freedom—oil, copper, rubber," said Lord Halifax, British Ambassador to America, in a speech at the Minneapolis Rotary Club. Lord Halifax listed these three as the most essential materials for winning the War and pointed out that the British Commonwealth of Nations dispose of some 70 per cent of the world's supply of oil, 85 per cent of the world's copper, still beyond Hitler's reach and no less than 91 per cent of crude rubber. "These are hard and simple facts which constitute a challenge to those doubting minds which cannot see certain assurance of the ultimate collapse and defeat of Hitler."

* * * * *

The combined Annual and Spring Conference of the (British) Geographical Association was held at Edinburgh, for the most part at the University Department of Geography. Special attention was paid to current affairs through lectures by (a) Professor J. L. Myres on "The Position of Greece in the Eastern Mediterranean," (b) Professor P. M. Roxby on "The Changing Structure of Chinese Society," (c) Professor M. P. Fleure on "The Mediterranean and Islam." The second day of the Conference was devoted to a Study of Edinburgh, with lectures by Mr. F. C. Mears on "Edinburgh, Past and Future" and Professor A. Ogilvie on "The Physical Setting of Edinburgh." Visits to see the various aspects of the City and motor excursions to the Stirling District and Ochil Hills formed part of the programme of the Conference.

* * * * *

The Oxford Colleges are making more provision for the award of Scholarships and Exhibitions in Geography. During the year 1941-42 Hertford College will again award a Scholarship of the maximum value of £80 for Geography. It has now been decided that University and Balliol Colleges, New College, Magdalen and Corpus Christi Colleges will include Geography as *one* of the subjects which may be offered for scholarships, Demyships and Exhibitions in Modern Subjects. Each candidate must offer two subjects of which Geography can now be *one*. It is thus possible for a Geography scholar to combine Geography *either* with the Humanities *or* with Science. The War has emphasised the value of Geography as a subject in Education and its importance is being increasingly realised in the University of Oxford. For example, there is now a separate Faculty of Anthropology and Geography.

* * * * *

The Third General Assembly of the Pan-American Institute of Geography and History was held at Lima (Peru), March 30 to April 6, 1941. Delegates representing 20 of the American Republics were enrolled as participants; and of the foreign delegations, those from Mexico and the United States were the largest. After a gracious welcome at the Government Palace, the Assembly was declared officially opened by the President of the Peruvian Republic who was also the Honorary President of the Assembly.

At the preliminary session the following sections were announced:—

- I. Topography, Cartography, Geodesy, Geomorphology and Geodynamics.
- II. Human Geography and Ethnography; Biological Geography; Economic and Historical Geography.
- III. Pre-History; Archaeology; Pre-Columbian History.
- IV. History of the Discovery, Conquest, Colonization, and Emancipation; America in the Present Epoch.

Although Sections I and II were arranged primarily for Geography and Sections III and IV for History, joint meetings of various sections were held when subjects of common interest were to be discussed. In Sections I and II some 75 papers were presented by their authors or read in abstract; in History and Archaeology the number was somewhat greater. The papers will be published in the Proceedings of the Institute.

Reviews

The Golden Hind Geographies: Second Series—Book 3: : The Gifts of the Earth. By Leonard Brooks, M.A., & Robert Finch. 272 pp. University of London Press. 1940. Price 3sh. 6d.

This book is the third of a series, which provides an alternative course to that adopted in the authors' Columbus Senior Geographies, and is designed for use by pupils from 11 to 15 years of age. After furnishing the groundwork in the shape of the Homeland (Britain) and the rest of the World in the first two books, they treat about the economic aspect of human geography in this volume in a simple descriptive way under such catching titles as 'Getting a living,' 'Geography helps to decide,' 'Man plays his part', 'Sea harvests' etc. Instead of the formal and academic methods of treatment that are usually followed, they have presented to the pupils first hand accounts of the life and work of peoples in many parts of the world, teaching at the same time simple geographical ideas and principles. The volume is copiously illustrated with excellent pictures and maps, which serve to render the subject matter vivid and lifelike. The notes under the pictures and the suggestive exercises at the end of each chapter compel the attention of the pupils to points and aspects, which might otherwise be neglected. The World base maps of the Major Geographical Regions and of the Population on the two fly-leaves serve for reference as well as for revision. The bold print, the glazed paper and the fine get-up make the book attractive. Though on account of the Departmental Syllabus, the volume cannot be prescribed as a text-book, yet we strongly recommend it for library reading by every pupil.

Man The World Over—Book 3. By C. C. Carter M.A., and H. C. Brentnall, M.A. xvi, 264 pp. Basil Blackwood, Oxford. 1941. Price Rs. 2 As. '4.

This is another book that lifts Geography from the beaten track and presents the material of its human side in a fresh and interesting manner on the foundations laid by the first two books. Ignoring the cataclysms of the moment the authors have gone to the fundamentals of Human Geography and discussed the topics of Food, Industry and Commerce, Population of the World, and Colonisation, each in a separate part. The treatment is original,

stimulating and suggestive, presenting descriptively facts which are usually omitted in ordinary text-books, making a fresh approach to the material. The numerous pictures, maps, and diagrams with the notes accompanying each, carry on the arguments further; and their interpretation as well as the suggestive questions given under each chapter afford valuable exercise in fixing the facts and principles in the minds of the pupils. The requirements of the Departmental Syllabus here may prevent the book from being used as a text; but it is strongly recommended for library study by every pupil and no school library should be without it.

Twenty Essential Studies in Geography. By George Noyle. viii +184 pp. Macmillan & Co., London. Price Re. 1 as. 9.

This book provides a simple revision course in Geography, helping to crystallise and fix the fundamental facts and principles of the subject, discovered by the children in their studies of the World and the Homeland (Britain). In part I the World is surveyed in simple climatic regions. "The prevailing geographical conditions are utilised to build up the main points of natural life, culminating in the effects of modern influences." In part II, which treats of the Homeland, "the work is based upon the essential needs of the people and the manner in which they are fulfilled according to the circumstances of geography and the demands of civilisation."

The well-defined maps in part I, while establishing the position of each region in the world, provoke at the same time the habit of reference to the atlas for further information. A unique feature of the book is the picture summary given at the end of each chapter, accompanied by groups of stimulating and instructive exercises. Among the latter are included further summaries in simple, concise sentences for note-book and memory work; reference work with the glossary printed at the end of the book; written tests; and useful and interesting exercises on the maps. The book is recommended for pupils' library, especially for individual work.

Living and Earning a Living : Book I—South India and the Southern Continents. By Helen T. Scudder, M.A., Dip. Geog. ix+149 pp. Oxford University Press 1941. Price Re. 1.

This is a text-book of Geography, suitable for use in Form I of schools in Madras Presidency, being prepared in accordance

with the recently revised Departmental Syllabus. Owing to the general prevalence of the vernacular medium of instruction in non-language subjects in the middle school forms, the few schools in which Geography is taught through the English medium have hitherto laboured under the disadvantage of having no suitable text-book in English for the use of pupils. That gap has now been partly filled up by this book under review, which we hope will be followed soon by text-books for forms 2 and 3 also.

The author, who is a keen and experienced teacher of Geography, has presented the matter in a refreshingly interesting manner adopting a simple descriptive style. The things "to find out" at the opening of each chapter and the stimulating exercises at the end of each provide material for individual and group work, and ensure pupil activity. The numerous pictures, maps and diagrams as well as the statistical data serve not only to throw further light on the subject matter but also to supplement it in a vivid and pleasurable manner. The book is strongly recommended for use as text-book especially in such of the South Indian schools, where English is the medium of instruction. Even in other schools, it can be used for supplementary reading.

Descriptive Geography for class IV (Tamil). By N. Subrahmanyam, M.A., L.T., F.R.G.S., and K. Ramamurthi, M.A., L.T., Dip. Geog. 60 pp. P. Varadachary & Co., Madras. 1941. Price As. 7.

Modern Geography has been filtering down from above in the schools of Madras Presidency. Twelve years ago the upper forms were touched; six years ago the lower forms; and the elementary schools have just now been reached. The book under review is the first of a series brought out in order expressly to meet the requirements of modern geography as prescribed by the new syllabus, just issued by the Department of Education. The matter has been carefully chosen and presented in a clear simple attractive style and illustrated with expressive pictures and maps. The printing and get-up satisfy the requirements of children's books—bold type, clear print and good paper.

Chromite in Mysore. By V. T. Venugopal, B.A. Mysore Geological Department. 24 pp. 1941. Price As. 8.

This pamphlet, issued as No. 2 of the *Popular Studies* of the Mysore Geological Department, is really a popular presentation

of a technical subject so as to be easily intelligible to the lay reader. After describing the appearance, detection, and mode of occurrence of the mineral, the author first gives a general account of the producing, business aspect and marketing of the ore, and then a detailed account of its production in Mysore, rounding it off with a brief statement of its metallurgical and chemical uses in peace and war as well as the statistics of production in recent years. Seven plates, two appendices and a map showing the chromite mining lease blocks in Mysore, illustrate the brochure.

The Oxford School Atlas for India, Burma and Ceylon. By John Bartholomew, M.C., M.A., F.R.G.S., F.R.S.E., 64 pp. Oxford University Press. 1941. Price Re. 1 as. 4.

This is the tenth edition of a very serviceable popular atlas, specially prepared to meet the requirements of Indian pupils, available at a fairly low price. Besides physical and political maps of the several continents and of the world, the atlas contains world distribution maps showing climate, population and occupations, special and section maps of India (with insets of the chief ports). Other useful features of the atlas are:—Population statistics of India, British Empire and other countries of the world; mathematical and astronomical diagrams; comparative diagrams of physical geography; illustrations of mapping; explanatory notes on time, maps and map-reading; historical maps of India etc.; and a complete general index (of names with pronunciation)—altogether a high value for moderate price. The atlas is recommended for use by pupils of secondary and high schools in India.

Select Contents from Periodicals

The Geographical Journal : March 1941.

The Islands of the Aegean—By Prof. J. L. Myres.

The Centres of England—By Col. Sir Charles Arden-Close.

The Geographical Journal : April 1941.

The Density of Agricultural Population in Scotland—By Catherine P. Snodgrass.

The Ouse Flood Problem—By W. E. Doran.

Geography : June 1941.

The Changing Structure of Chinese Society—By Percy M. Roxby.

The Social Structure of France—By Robert Niklaus.

Agricultural Divisions of Wales—By A. E. Owen.

Instructional Films and Educational Films—By J. Fairgrieve.

An Experiment in the Integration of History and Geography—By M. Humphreys-Edwards and M. H. E. Murray.

Southern India Commerce : June 1941.

Economic Resources of Madras Presidency : Oilseeds (Miscellaneous).

Indian Information : June 15, 1941.

How Burma Came into Being—Geological Survey of India Memoirs.

Indian Information : July 15, 1941.

Facts about Syria : A Political, Physical and Ethnological Description of the country.

Geographical Review : July 1941.

The Personality of Mexico—By Carl O. Sauer.

International Contrasts in Food Consumption—By Merrill K. Bennett.

Notes on the Climate of the South Chinese-Tibetan Borderland—By J. Hanson-Lowe.

Colonial Brazil as a Way Station for the Portuguese India Fleets—By Alexander Merchant.

Preliminary Account of the United States Antarctic Expedition, 1939-1941—By Lt. Commander R. A. J. English.

The Great Cities of the United States, 1940—By Mark Jefferson.

Certain Changes in Population Distribution in the United States—By John K. Wright.

Books and Journals Received

- Living and Earning a Living : South India & the Southern Continents* : By Helen T. Scudder.
- The Gifts of the Earth* : By Leonard Brooks & Robert Finch.
- Twenty Essential Studies in Geography* : By George Noyle.
- Man the World Over, Vol. 3* : By C. C. Carter & H. C. Brentnall.
- Descriptive Geography for Class IV (Tamil)* : By N. Subrahmanyam & K. Ramamurthi.
- The Oxford School Atlas for India, Burma & Ceylon* : By John Bartholomew.
- Chromite in Mysore* : By V. T. Venugopal.
- Recent Geographical Literature, Maps and Photographs* : Royal Geographical Society, London.
- Report on the Operations of the Department of Agriculture, Madras Presidency for the year 1939-40.*
- Report on the Work of the Agricultural Research Station, Guntur for the year 1939-40.*
- Southern India Commerce* : June 1941.
- Journal of the Andhra Historical Research Society, Vol. XIII, Part 1.*
- Indian Information* : June 15, July 1 & 15, August 1 & 15.
- South Indian Teacher* : July & August 1941.
- Kalaimagal*, June, July and August 1941.
- Nagari Pracharini Patrika* : Vol. 46, No. 1.
- The Indian Co-operative Review*, January-March, 1941.
- The Geographical Journal* : March and April 1941.
- Journal of the Sri Venkateswara Oriental Institute* : January-June 1941.
- The Indian Journal of Political Science* : July-September 1941.
- Geography* : June 1941.
- Geographical Review* : July 1941.

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Market Villages and Periodic Fairs of Bombay Karnatak

By

C. D. DESHPANDE, M.A., DIP. GEOG. (LOND.),
Karnatak College, Dharwar.

Economic organisation cannot be explained only by a broad reference to cities, trade centres and villages and the means of communications connecting them. Within this network market villages and periodic fairs play a fundamental role in rural economy. Under less advanced conditions when urbanisation is in its infancy, "the smaller village community has no shops and those which exist are usually found in the house of some one who makes a living by other means, for the market is too small to support a storekeeper."¹ Market villages and periodic fairs are the outcome of a natural process whereby certain villages and sites specialise in their functions and become commercial centres of the surrounding areas, with this obvious difference that the market villages cater to the needs of smaller areas at more frequent intervals, while the periodic fairs are essentially seasonal in nature and claim a much wider commercial allegiance. Unless and until the rural community reaches a very high stage in development, such as that of the U.S.A.² it is marked by a pattern of market villages and periodic fairs which are

1. Sanderson: *Rural Community* p. 308.

2. *Ibid.*, pp. 442 and 564.

the main connecting link between the rural community and the outer world.

As Sanderson points out this is true of every community, except the most primitive, in the world.³ Market villages and periodic fairs have played a significant role in the national economy of many countries when human contact was purely local, means of communications inadequate and rural economy simple and medieval. Dickinson has shown this to be the case in his study of the Medieval East Anglian market towns.⁴ J. Lossing Buck shows the present day strength of such organisation in his study of China.⁵ In an advanced community, however, the market villages and fairs lose their importance. Market villages decline in number though some of them get a new lease of life when they become administrative centres, and the growing commercial town makes its mark.⁶ Growth in the means of communications and the development of larger villages seem to be the leading factors in the evolution.

Bombay Karnatak—its geographical features

The Bombay Karnatak is a small but culturally homogeneous part of the Bombay Province. (Map. 1) Administratively it belongs to the four southern districts of Bombay Province Belgaum, Bijapur, Dharwar and North Kanara, and includes some S.M.C. States.⁷ The four districts have an area of 18874 sq. Miles and a population of 3466433 persons. Geographically, it resolves itself into four distinct natural regions—the narrow coastal plain of Kanara, the Sahyadri Ghats, the Transitional Zone to their East and the Eastern Plateau. From the point of view of economic development, it is primarily an agricultural region—a region of diverse crops.⁸ Millets on the plateau and rice on the lowlands are the major crops but far more important are the commercial crops of Cotton, Wheat, Tobacco, Sugarcane and oil-seeds which form the backbone of the economic prosperity of the

3. Sanderson: p. 150ff.; and pp. 308-320; Mantoux: *Industrial Revolution in the 18th Century*, pp. 111-116.

4. *Geography*, XVII, Mar. 1932.

5. Quoted by Sanderson in *The Rural Community*.

6. Cf. Stamp: *British Isles*, p. 566.

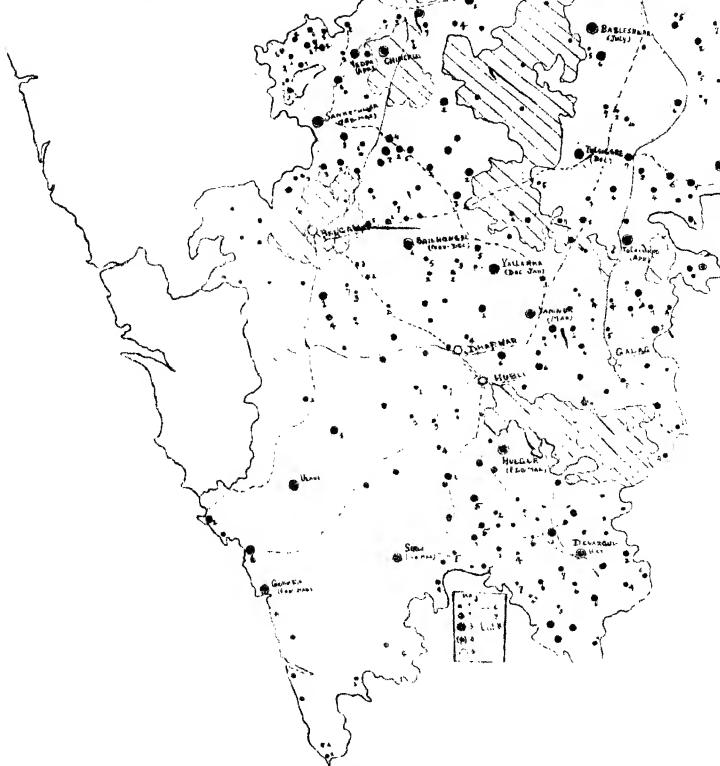
7. *Statistical Atlas of the Bombay Presidency*, 1925.

8. Simkins: *Agricultural Geography of the Deccan Plateau*; and "the coast plains of India" contain a brief account of Karnatak and its agriculture.

MAP II
Scale: 1:1 M.



MAP I



MAP I

Geographical and Administrative divisions

- I. Kanara Coast; II. The Sahyadries; III. The Transitional Tract;
- IV. The Eastern Plateau.

MAP II

Distribution of Market Villages and Periodic fairs and their dating.

1. Market villages with a population between 500—1000;
2. Market villages with a population between 1000—2500;
3. Market villages with a population between 2500—5000;
4. Periodic Fairs;
5. Towns;
6. Railways;
7. Roads (major); and
8. S.M.C. States.

Note:—Marketing day of each village is indicated by numbers beginning with 1 as Sunday.

people. In fact Bombay Karnatak is known for its Cotton, Wheat and Oilseeds. Both from the point of occupational distribution of population and the percentage of land under cultivation Bombay Karnatak is prominent as an agricultural region.⁹ It is the region of rural communities.

Although industrially unimportant, commercially Bombay Karnatak is a well developed region owing to its agricultural prosperity in the past. A system of North and South Railways, and East and West roads, brings the Country in contact with its neighbours, Maharashtra, the Nizam State, Bellary, and Mysore, while the secondary roads mainly developed by the District Local Boards break the isolation of some rural areas. The Urban development of Belgaum, Hubli, Gadag and Bijapur is essentially commercial, based on the export of agricultural products. Distribution of population closely corresponds to the economic productivity of different regions. It is greatest in the Transitional Zone and least in the Ghats. Frequent incidence of famine seriously reduces the density of population in Eastern Karnatak in spite of its productive capacity.

Market Villages—their distribution, routine and functions

The distribution of market Villages in Karnatak (Map 2) is influenced by a variety of forces. In the densely populated agricultural plains of the Kanara Coast market Villages are few in number. The Taluka towns like Karwar and Honawar, in the main, are the marketing centres. The forested Sahyadries are backward in practically every respect and only the 'gap' towns of Haliyal, Yellapur, Sirsi, and Siddapur which control the Ghat roads connecting the Kanara Coast and dry Karnatak, are the market villages. The transitional belt shows the greatest development of market villages both in their size and number because of the high commercial development of this 'Contact Zone.' Further east too the number of market villages is quite large, but most of such villages have a smaller population and lesser economic importance, a feature explained by the frequent famine conditions and the general poverty of Eastern Karnatak. However there are certain common features. In almost every case the market is held once a week on a traditionally established day. It is interesting to note in this respect that neighbouring market villages

instead of competing with each other co-operate in their economic function as their market days are by custom fixed in a rotation of the days of the week. (Map 2). Business starts late in the morning; it reaches maximum activity in the afternoon, when village folks from the neighbourhood come there with their agricultural produce and buy in exchange other necessities such as salt, kerosene oil, cloth etc., which are mainly brought from towns by itinerant merchants and in the old days by 'jogties.'¹⁰ (The goods were transported either on pack-bullocks or by carts. Improvements in roads in the last quarter of the 19th century resulted in increasing use of carts which used to ply between the Konkan and the Desh tracts). Exchange and bargaining over prices take place in case of almost all commodities. Small articles of luxury and sweetmeats are also sold. By four or five in the evening the work of the day is done and everyone is eager to return home in parties of ten or twelve in good mood gossiping and singing to shorten a long weary trek which may well extend to eight to ten miles in many cases. The *Bombay Gazetteers* (1881) give a good description of the working of these villages in different parts of the country. There is little variation except in the nature of the agricultural products that are sold. In Kanara local products of the Coast and the Ghats are exchanged at market villages like Gersoppa although the 'Desh' produce and minor manufactured articles imported from Eastern Karnatak and Bombay find an increasing market. In Belgaum—most of which belongs to the Transitional Zone and Eastern Plateau tracts—"the weekly markets are both collecting and distributing centres. The chief articles are butter, salt, grain, cattle, cloth, molasses, and sugar, iron, brass; copper, and earthern vessels, oil, spices and tobacco. The sellers are generally retail and sometimes producers. The buyers are generally consumers who live at or near the market towns. There is little barter. The articles which are gathered at these markets are local produce chiefly cotton, tobacco, oil, salt, rice, hides, fat, butter and molasses. The sellers are growers and petty dealers, and buyers are local traders and agents of Bombay merchants."¹¹ In Dharwar "except for the ten chief trade centres weekly markets are held at almost all towns and large villages."¹²

10. *Bombay Gazetteer*: Belgaum, p. 315; Kanara, p. 57.

11. *Belgaum Gaz.*, p. 315.

12. *Dharwar Gaz.*, p. 357.

"Markets are generally held in the middle of the town or village, from eight in the morning to five in the evening." In Bijapur the routine is the same, the only difference being the greater importance of millets in the exchange economy.¹³ This general description of the markets written in 1881 is true even to-day, except in two respects. The development of motor transport is rendering the cart transport an obsolete feature in the organisation of some highly commercialised regions such as the northern parts of the Belgaum District. No longer do the market villages serve as collecting centres of local produce. Good roads, agents of the Bombay grain and cotton exporters, and the desire of the rayat to get better prices are shifting the collecting functions from the market villages to commercial towns. The returns of the Cotton Sale societies and the municipal octroi returns of Hubli and Gadag prove this new trend.

Regional differences

Apart from the difference in the kind of local produce sold at these markets, there are other regional differences as well. For obvious reasons most of the market villages of the Coast and the Ghats cease to function during the monsoons. On the basis of *population*, market villages of the coast and the Ghats are small villages with a population varying between 300 to 1500 persons, those of the Transitional Zone have a population varying from 2500 to 5000 persons. The Eastern Karnatak Market villages are necessarily small with a population not exceeding 2500 persons.

For assessing the *economic importance* of the market villages it is also necessary to take into account the value of transactions taking place on every market day of each village in addition to the number of population. On this basis, the market villages of the transition zone are the most important, since value of transactions in their case is usually greater than Rs. 2500 while in the Ghats and on the Coast it hardly exceeds Rs. 50 at a time. Similar

13. *Bijapur Gaz.*, p. 363.

conditions in the Eastern Karnatak point out to the poverty and the low standard of living of the inhabitants of both the regions.¹⁴

Periodic Fairs

Far more important than the market villages and trade centres, are the periodic fairs held in various parts of Karnatak. These

14. Cf. e.g., The three taluks of:—

<i>Market V.</i>	<i>Population.</i>	<i>Value of Transactions Rupees.</i>
(1) <i>Sindgi</i> (Eastern Karnatak)		
Sindgi	4,369	1,000
Hippargi	3,374	1,000
Chandkavthe	2,333	75
Algur	1,214	20
Kondaguli	1,552	30
Kalkeri	2,236	50
Karwar	2,692	100
Golgaeri	966	150
Almel	3,789	500
Devangaon	2,115	150
Malghan	1,158	75
Moratgi	1,491	100
Bhantnur	651	75
(2) <i>Ranebennur</i> (Transitional Zone).		
Ranebennur	16,411	10,000
Byadgi	7,112	15,000
Motebennur	3,269	10,000
Halgeiri	2,775	2,000
Medleri	2,820	2,000
Tumminkatti	5,558	6,000
Karur	1,917	1,000
Bisalhalli	....	500
Airani	1,227	100
Kuppelur	1,650	200
(3) <i>Bhatkal Petha</i> (Coast).		
Mavalli	4,829	50
Shiralli	4,768	75

(Note the density of population for the Petha which is more than 259, per square mile).

are held in honour of local deities and draw a large number of devotees, from distant places, whose zeal and desire to purchase novelties create a good market. Such are the leading fairs of *Chinchli* (S.M.C.State), *Yamnur*, *Yellamma*, *Sankeshwar*, *Yedur*, *Sirsí*, *Ulavi*, *Sangam* and *Mangasuli*, which draw a large attendance varying from 20000 to 50000 persons from all parts of Karnatak and neighbouring provinces. The influence of climate and harvesting seasons is apparent in the dating of these fairs. The fairs of Kanara are held in February and March just when the harvesting is over. Most of the Dharwar and Belgaum fairs are held during March and May period, but some are held in the months of October, November and December; Bijapur fairs are either in October and November or in April and May. Just as in the case of market villages, there is a continuity in the dating of different fairs. No two fairs in the neighbourhood are at the same time of the year. This naturally avoids competition and enables the itinerant traders to visit almost all the fairs with their merchandise. In the 'siting' of fairs local events and anecdotes of religious importance seem to be a more important influence than the geographical setting. But from the point of view of distribution of fairs and the attendance they draw, there are regional differences. Kanara has three leading fairs but no smaller ones. In Eastern Karnatak the *Sangam* fair (held in honour of Basava the founder of the Lingayat Sect) is the only large fair of note, while there are many smaller fairs dotted all over the district which are hardly important from the point of view of attendance and the value of transactions. The Transitional Zone however can boast of both large and small fairs.¹⁵ In fact all the famous fairs of Karnatak are concentrated within this narrow zone and its explanation can only lie in the economic prosperity of its inhabitants in the past.

Most of these fairs are mainly *distributing centres*. In olden days these were the chief means whereby goods produced in far off places like Benares, Cambay and Madura found a market in the rural parts of Karnatak. Economic need supported by religious motive seems to be the real explanation of the evolution of these fairs. Preliminaries are worked out by local 'elders' of the village at the approach of the fair festival. Ground

15. Enquiries from local revenue authorities; based on their record.

is demarcated; shops are arranged; devotees begin to flow in in large numbers, worship of the gods is accompanied by purchases and amusements; cloth, small articles of hardware, agricultural implements, cattle, metal and earthen vessels, toys and small articles of luxury and novelty always command a good market; transactions in agricultural produce are practically absent; in case of more valuable transactions such as a good pair of bullocks or a good milking buffalo much bargaining takes place and bargains are finally struck on the very last days as both the buyer and the seller want to make the most out of it; till then cattle are exhibited in long rows in some cases to parade a good breed without any intention of selling. Sweetmeat marts, hawkers, dramatic performances, wrestling bouts, a company of acrobats and in these days the "talkies" add to the lighter and brighter side of the fair; this attractive side of the fairs explains the local zeal and excitement and the large attendance. The fair is controlled by local Panchayat and the trustees of the local deity, and nowadays supervised by Taluka or District authorities. Cholera and plague epidemics of 1925 and 1926 in certain fairs have resulted in the increasing supervision by the Public Health Department. Poll tax, receipts of the shop ground rent, grant from the Government or from the Temple revenues support the financial structure of the fair which in many cases become a profitable proposition. The fair reaches its fullest development on the day of the 'mahapuja' or 'grand worship'; a larger attendance of buyers and sellers sometimes induces the authorities to extend the fair by one or two days but in about three or four days after the mahapuja every fair comes to a close and traders get busy in packing their wares in order to move to the next neighbouring fair. The economic importance of these fairs may be seen from the fact that at the Shankeshwar fair in Belgaum and Golegeri fair in Bijapur transactions worth Rs. 20,000 take place every year. Some of these are specialised fairs. The fairs of Yedur and Chinchli for example are known for their cattle transactions.

It is needless to point out that these fairs like the fairs of Medieval Europe have played a vital role in the past in bringing the countryside in contact with the outer world, and even to-day with the development of commercial towns and communications, it cannot be said that there is an *all round decline* in these fairs. Indeed the evidence is conflicting. Fairs of coastal tract and the Ghats (Ulavi and Sirsi) are exhibiting a tendency towards

decline.¹⁶ But some of the fairs of the Transitional Zone and the Eastern plateau are drawing the same attendance as they did in 1882; and the value of transactions is now greater than before. Hippargi fair in Bijapur which used to draw an attendance of 30,000 persons in 1882, has declined very rapidly and now-a-days draws only 1500 persons but in this case too there is an increase in the value of transactions.¹⁷ It would be interesting to analyse and explain this survival of Karnatak fairs in modern times. Could it be due to the rising standard of living and the greater exchange needs of the people today that the fairs find their justification in face of the competing commercial towns? It would be an interesting enquiry for the economist.

Market villages and their geographical setting

Vidal de La Blache has pointed out the importance of man as a geographical factor. "Physical causes, whose value geographers have been fond of pointing out, are not without influence.....it is always necessary to note the effect of climate and relief, as well as that of continental or insular position, on human societies. But we should observe their effects on men and on the whole of the living world conjointly. In this way we are in a position to better appreciate the role which should be assigned to man as a geographical factor. He is at once both active and passive."¹⁸ The

16. Table 1.

Table 1.
Trend of Representative Fairs

Year	Ulavi		Sankeshwar		Hippargi		Golegeri	
	(Ghats)	1	(Transitional Tract)	1	2	(E. Plateau)	1	2
1900	15000	12000	8000	10000	4000	15000	10000	150000
1921	13000	10000	10000	15000	2000	10000	15000	100000
1931	10000	8000	13000	20000	1500	8000	120000	200000

- 1. Represents attendance.
- 2. Represents value of transactions in Rs.

17. *Bijapur Gaz.*, p. 363, per cent information based on references to local authorities.

18. *Human Geography*, p. 19.

pattern of human establishments is primarily influenced by natural environment but complex factors influence the evolution of settlements in the old and long established countries.¹⁹ In the evolution of market villages, the *selection of site and the nature of commodities exchanged* are mainly determined by natural factors, but far more important is the human influence which shapes out their pattern and gives them their fuller significance. Evolution of market villages is generally due to the *indirect influence* of man working through the means of communication which he develops, the density of population, the economic development of the particular region (which again is the result of his effort), and the standard of living or the level of comfort to which he wants to draw on the gifts of nature.

The origin and growth of market villages is generally attributed to the absence of *means of communications*.²⁰ It is also asserted that with the growth of commercial towns and means of communications, there sets in a decline in the functioning of market villages. Neither of these satisfactorily explain the market villages of Karnatak. The Coastal and Ghat tracts have few markets in spite of the poor means of communications and comparatively greater isolation of the rural areas. Without the necessary human background for a support, the mere fact of insufficient communications holds very little meaning in it.

With reference to the market towns of England, Stamp points out to the development of roads and the subsequent decline of market towns. "The gradual development of road transport after about 1760 in particular, resulted in concentrations of marketing in fewer towns due to the increased marketing radius which was possible."²¹ There has been some growth of communications in Karnatak during the last fifty years, but there is no evidence to show that the market villages are materially suffering a decline. A new trend is apparent. The growth of communications have strengthened the commercial towns, and the majority of the market villages have now ceased to act as collecting centres of local agricultural produce. The desire of the rayat to obtain a

19. *ibid.*, p. 274.

20. Mantoux: p. 115; Vidal La Blache: p. 385 "the location of such markets was determined by the necessity of making the journey to and fro in one day." In eastern Karnatak a spacing of 10 to 12 miles is clearly seen; Cf. the distance bet. East Anglian markets as given by Dickinson,

21. D. Stamp: *British Isles*.

better price, the travelling agents of the Bombay export firms, and the policy of the Government to encourage the agriculturist to sell his produce through the sale societies have shifted the function of collection from the market villages to the commercial towns. Nevertheless the importance of the market villages remains as before and in the Ghats seem to be on the increase, since efforts are being made by the authorities to develop some market centres in this region.²²

Density of population has no such simple and direct correspondence to the number and economic importance of the markets. The Kanara Coast has a high density but a few market villages and the Eastern Karnatak a comparatively low density but the number of markets in each Taluka is quite large.²³

Similarly *economic development* of a region, by itself, cannot evolve a pattern of rural markets. Agricultural production is quite intense on the Coast. Frequent famines severely handicap the productivity of Eastern Karnatak and this has little correspondence with the distribution of market villages.

22. E.g. in Yellapur Taluka, Kanara Dist. (Ghats Tract).

23. Table 2.

Table 2
Market Villages and Population

Geog. Region	Taluka	No. of villages in the taluka	Density of popu- lation per sq. mile	No. of Market villages	Value of trans- actions per week
Kanara coast	Bhatkal	56	304	2	125
	Karwar	58	229	1	1,000
Ghats	Haliyal	103	68	2	*
	Sirsi	242	78	2	6,000
Transi- tional tract	Sampagaon	124	303	14	*
	Ranebennur	119	269	10	47,000
Eastern plateau	Bagewadi	119	136	9	*
	Sindgi	142	121	13	3,500

*Figures not available

It is apparent therefore that of the indirect human factors influencing the evolution of markets, no *single* factor can offer a satisfactory explanation. Market villages are the expression of a developing rural community desirous of promoting wider contact outside their home, on the economic basis of exchange of products. In a way they mark the transitory phase in social evolution: from the primitive stage to the most advanced. Increasing urbanisation and commercial development is bound to affect rural market centres sooner or later.²⁴ But the process as in U.S.A. must be complete. The commercial towns must completely cater to the exchange needs of the rural community so as to render the market villages a redundant feature in the rural economy. The existing organisation of market villages and periodic fairs of Karnataka today must be explained by the fact that the commercial towns of Karnataka have not completely supplanted the lesser commercial settlements of market villages and periodic fairs. Increasing contact, diffusion of ideas, and a desire to better the standard of living and the consequent increase in the volume of transactions in rural areas are sustaining and in some cases promoting the importance of these rural market centres.

24. F. G. Thomas: "The Changing Village" for the influence of roads and towns on rural areas in England, p. 14ff., and for U.S.A., Sanderson: p. 460ff.

The Geographic Basis of the Legendary Origin of Kerala

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Of the several legends in vogue at the present day regarding the origin of Kerala, two are particularly noteworthy. In his Letters, Visscher¹ gives an account of one of them as follows:—"In by-gone ages, the sea washed the foot of a mountain range which now lies 7 or 8 miles inland. The men who dwelt in the neighbourhood gained their subsistence by fishing along the mountain shores. Now it happened that there dwelt at Gokarna (near Goa vide Map 1) a certain prophet, universally renowned for sanctity whose name was Paroese Raman (Parasu Raman). Discovering to his sorrow that his aged mother had acquired an evil notoreity in the neighbourhood for her mischief, he felt unable to endure the public shame which she brought upon him. At length inspired by a divine impulse, he seized a rice winnow and hurled it with a tremendous force from Gokarna right over the sea. By a wonderful miracle, it was carried onwards as far as Cape Comorin, upon which all the sea between the two places dried up and was transformed into that tract of level land to which we now give the name Malabar. The prophet resolved to take his abode with his mother in this strange land, hoping here to find a hiding place for her disgrace. Meantime, the fishermen of the mountains hearing of the miracle, flocked into the lowlands and made for the sea-shore. The prophet met them and induced them to stay in the country and to facilitate this, invested them with the dignity of Brahmins."²

1. J. C. Visscher's Letters. See K. P. Padmanabha Menon, *History of Kerala*, Vol. I, pages 1 and 2.

2. It is said that the Nambudri Brahmins are the descendants of these fishermen. Among the Nambudries, after the marriage ceremony, the bride and bride-groom play with fish and this custom has been cited as a piece of evidence to trace their descent to fishermen. Nagam Aiya in his *Travancore Manual* explains this ceremony as merely an invocation to crown the

The second version of the legend states that "when Parasu Raman was doing penance on the mountain of Mahendra, where after having gained the 21 victories over the Kshettries, he laid up all his arms, the chief muni or saint came to see him and having saluted him, advised him to cause the sea to recede and to bring to light the land of Kerala....Parasu Raman immediately went to the neighbourhood of Gokarnam and hurling an axe recovered the land from the sea as far as to where the weapon fell. Having thus created the land of Kerala, he summoned the Brahmins from a foreign country and made over the country to them."³

These legends are not to be rejected as altogether puerile; they have indeed a core of truth in them. In this paper, I shall endeavour to explain how they chronicle in the imaginative style of the poets the effects of the changes of the shore-line, merely describing in a figurative manner the fact that the lowlands of Kerala have been raised from the sea. The evidence that could be adduced in support of this contention is manifold, but they can be classified into two main groups, namely (1) the geological and (2) the literary and historical.

Geological evidence. The great cliff-like scarp of the Western Ghats and the gently sloping country at its base, suggest the action of marine denudation on a great scale, operating during a period of gradual elevation.⁴ The isolation of the different hill ranges of

married couple with wealth. Nevertheless, it must be admitted that the Nambudiries of Kerala have several customs peculiar to themselves and entirely different from those of their more easterly cousins, e.g., the post-puberty marriage; primogeniture and that to an extreme form in which only the eldest son is allowed to marry within the community, etc. It is also suggested that this ceremony may have something to do with the promiscuity of fish. Is it then merely an invocation to bless the married couple with a large progeny? Dr. Guha has arrived at the conclusion (vide Census of India, 1931, Vol. I—India, Part 3; pages 35 and 57) that the racial characteristics of the Nambudiries, indicate that they are not indigenous to Malabar. On the basis of the C.R.L., their nearest relations, except for Nairs, appear to be the Brahmins of the United Provinces. There are also traditions of their migrations from the United Provinces. It is thus probable that there is no truth depicted in this part of the legend.

3. Notice the proximity of 500', 1000' and 3000' contours indicating the steep slope—Vide Map II.

4. *Memoirs*, G.S.I., Vol. 12, page 12. See also Oldham *Manual of the Geology of India*, page 10. "The escarpment of the Sahyadri-range has frequently been noticed as furnishing evidence of a rise of land."

Southern India and the denudation of the Palghat gap are due in part to ancient marine action.⁵ It is true that Kerala has not been thoroughly surveyed by geologists, but nevertheless, direct evidence in support of the marine origin of its coastal regions is not wanting. Thus, fish bones and shells have been found in some borings of the Kallayi river. Near Kuttipuli at a height of about 250' above sea level, several marine and estuarine shells were found scattered on the surface. In the banks of the Beypore river, similar collections of shells are found, sometimes at considerable height above the sea. At and near Cape Comorin occur a few patches of marine beds containing recent fossil marine shells.⁶ The banks of the Ponnani river near Kuttipuram are loamy and close to the top of the bank, collections of shells were found together with a piece of semifossil resin.⁷ The existence of coral reefs below the alluvium of Vazhappally⁸ conclusively shows that the sea once extended upto the eastern shores of the back water. Corals are sea animals that cannot live and thrive above the level of the lowest tides. It is therefore clear that the seas must have covered Vazhappally and the top of the coral reefs observed at Vazhappally must denote the level of the lowest tides. It has also to be inferred that the shore-line of the time was further inland than at Vazhappally; for otherwise, the sea over Vazhappally would have been so muddy as to prevent the growth of the corals. Since corals live and thrive best when the depth of the water is 30 to 40 fathoms (approximately 250 ft.) the sea at Vazhappally could not have been deeper than this at the time the reef was being formed.

Nor is this evidence of upheaval confined to the coastlands of Kerala. In recent times Rameswaram island must have been uplifted as is evidenced by the existence of an upheaved coral reef, very extensive indications of which occur round the northern coast

5. Probably of the same date as the formation of the Sahyadri escarpment. It is far from improbable that if the sea ever extended to the Western Ghats, the epoch belonged rather to a tertiary than post-tertiary times.

6. *Helix Vittata*, a land shell of a living species. Vide Records G.S.I., Vol. 16, Part 1; page 30 and Records of the Department of Geology of Travancore, Vol. 1, page 29.

7. Probably these shells were placed there by human agency as very recent pottery was found along with them.

8. Records of the Department of Geology of Travancore, Vol. I, p. 28.

of the island.⁹ Likewise in Bombay the littoral concrete¹⁰ seen on the west side of the island must have been formed at a lower level than it now stands at. The evidence of a rise in land is trifling at Bombay, but is much greater at Kathiawar.¹¹ Again in Valimukham bay in the Tinnevelly district, indications of uplift are found in the occurrence of Pottamides and other littoral marine shells in clay, above high water level, showing that this clay must have been elevated since it was formed.¹² It is therefore clear that the coast lines of Kerala and the adjoining regions of India have by no means remained steady. On the other hand, they have been moving upwards in recent times.¹³

9. *Memoirs*, G.S.I., Vol. 20, pages 69 to 73. The island of Rameswaram which is 11 miles long is only 2 miles away from the mainland and local tradition claims that the island was once completely joined to the terra firma on both sides and that both the Pamban Straits and the various breaches to the eastward have since arisen by a cataclysm in the form of a tremendous storm in about 1480 A.D.' Kanakasabhai Pillay in his *Tamils 1800 Years Ago* records a similar irruption of the sea on the south-west coast of the island of Ceylon. (page 21). The abrupt manner in which Point Raman on its coast terminates and its geological formation which can be traced across the ridge of rocks to the island, almost confirms this supposition and the opinion is strengthened by the records at the temple of Rameswaram which state that until the early part of the 15th century, the island was connected with the mainland and on particular festivals the idol of Rameswaram was carried in procession to a temple on the mainland. The legend of Hanuman and Nala making blocks of stones to float on the water is only an elevation of the sea bottom—a miraculous event ascribed to superhuman agency and the fervid imagination of successive Aryan bards may be easily credited with sufficient powers of invention to have evolved all the marvellous mythical details that have been super-added by way of embellishment. Do we not see here an analogy to the legend of Parasu Raman ?

10. This consists of shells, corals, pebbles and sand cemented together more or less thoroughly by carbonate of lime. It is used as an inferior kind of building stone.

11. Oldham, *A Manual of the Geology of India*, page 409.

12. *Memoirs*, G.S.I., Vol. 20, page 83.

. 13. It must also be added that geological evidence is not wanting to show that subsidence also has taken place in some of these regions. See Oldham, *op. cit.*, pages 405 and 407; also note on the Narakkal mud banks in the Administration Report of Travancore, 1881-82, and the article by Dr. Day in *The Madras Journal of Literature and Science*, Vol. 22, pages 261 and 262.

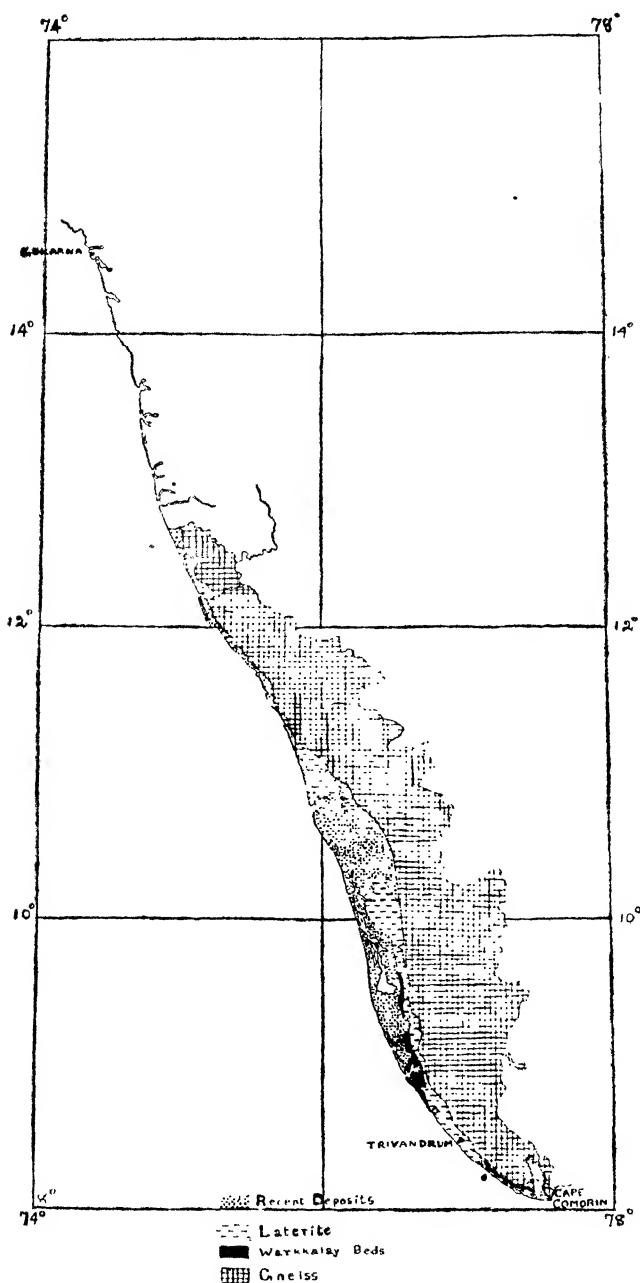
The main rock formations of Kerala (Vide Map I) are the prevalent and foundational crystalline gneiss series occurring mainly on the scarps of the Western Ghats to the west of which lie the lateritic formations, the Warkkalay beds and the recent deposits, in the order enumerated above. For the purpose of this paper, there is no need to consider the features of the easternmost of these rock formations, namely the gneiss series. A consideration of the characteristic features of the other rock formations however, throw a considerable amount of light on the problem of the shore-line.

Laterite is mainly of two types, (1) the plateau laterite (the residual laterite?) and (2) the terrace and valley laterite (sedimentary laterite?).¹⁴ The plateau laterite occupies a zone between the Warkkalay formations or the recent deposits in the west and the crystalline gneisses of the east.¹⁵ The lands lying above flood level are comparatively free from this formation and from this it appears that extensive lateritisation is a subaqueous phenomenon suggesting that this belt of plateau laterite must have been under water in a former age. The belt of plateau laterite is not higher in level (as is fully evidenced by the position of the 250' contour) than the Warkkalay formations which are doubtless of aqueous origin. It is probable that when the Warkkalay beds were under water, the western fringe of the crystalline rocks was also under water. It is also probable that a layer of Warkkalay formation was overlying the fringe which has since been denuded.

It would be interesting to make a detailed study of the topography of the lateritic regions. Thus the land immediately to the east of the coastal formations near the mouth of the river Ponnani rises suddenly to a height of 100' to 150' and presents somewhat a cliff-like aspect to the sea, e.g., at Trikkannapuram, Naduvallam, Anakkara etc. This cliff is the western edge of the laterite plateau of Malabar which has been cut by many river valleys and the low-

14. *Memoirs, G.S.I.*, Vol. 24, page 221. The plateau laterite has been formed on a plain of marine denudation and the terrace and valley laterites in river valleys.

15. Small patches of plateau laterite may be seen (not marked on the map) on the crystalline rocks as in Nilambur further east than this zone of general lateritisation. Why lateritisation is more general in this zone than in the more eastern parts of the crystalline rocks is uncertain, but possibly because the residual products of decomposition cannot be retained on those slopes in the torrential rains of Kerala.

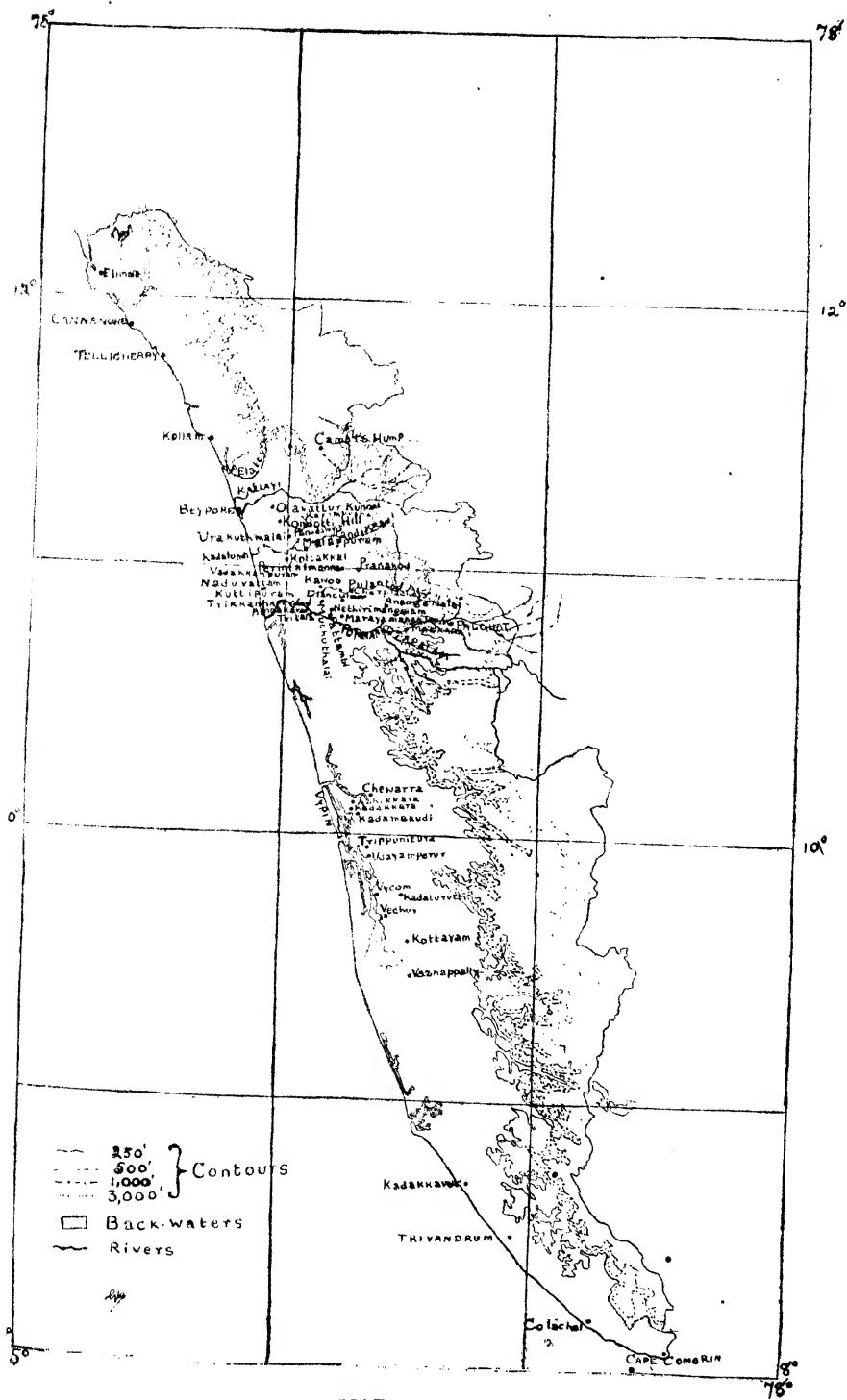


MAP I

lying country runs in tongues up these valleys far beyond the limits of the main coastal area. If the region east of this cliff is examined, it is found that it is undulating in the west with shallow valleys, but it steadily increases in elevation eastwards and the valleys become deeper, more or less gorge-like and 300' to 400' deep. In some cases, a broad valley has first been cut in the plateau and a deep and narrow gorge is carved in this valley; in others the valleys are terraced.¹⁶ The narrow West Coast thus presents unmistakable traces of a plateau character and this is best displayed about Trivandrum, Malappuram and in several parts of the Chirakkal taluq. The terraces touch the sea and form a low cliff at Mount D Eli (Elimala), at Cannanore, at Tellicherry and thence almost continuously on to Mahe, at Kollam near Quilandy and for a few miles north of it, and lastly at the Elattur river mouth. South of Trivandrum these marks generally disappear the last trace being Colachel.

Selecting South Malabar as one of the characteristic lateritic regions, it is found that the broad valleys cut in the plateau are analogous to the valleys in the undulating region just east of the cliffs. Further inland, the country becomes undulating like that near the coast, but is flatter and is really a plain with shallow valleys. This type of country extends to the foot of the Ghats and is about 250' to 350' above the sea. Thus we have the coastal region which lies outside the plateau forming a ledge, but east of it a plateau with an undulating region which is comparatively low. It rises gradually to the central region and then steadily sinks towards the foot of the Ghats. The slope is very gentle, both to the west and the east and also to the north and south; about 15' to 18'. The resemblance to a plain of marine denudation is perfect—the highest parts being in the neighbourhood of Urakuthmalai (1567'), Pandalur (2002') and Pranakod hill (1786') which must have been islands before the plateau began to rise above the sea. If the whole country of South Malabar sank about 500', these hills would be islands lying in the middle of a bay, the coast being at the foot of the Western Ghats. This must undoubtedly have been the condition of this region before the laterite period. South Malabar was then a bay bounded on the north by the Camel's hump and its outlying ranges and on the south by the

16. *Memoirs, G.S.I.*, Vol. 24, page 224. The small streams are also often terraced e.g., 3 miles S.E. of Kottakkal.



MAP II

Cochin hills. In the middle of the bay rose a chain of islands, Olavathur Kunnu (804') Kondotti hill (about 780'), Urakuthmalai, Pandalur and Pranakod. This is now the highest part of the plateau. As the land rose, a ledge was formed round the chain of islands, and the ledge became broader as the land continued to rise till at last it joined the Ghats near the peak of Kanjacombu, thus dividing the bay into two. This line of division is the watershed between the Pandikad and Ponnani rivers. At length when the present level was reached, instead of two bays, were two valleys to the north and south of the highest parts of the plateau running from east to west through which flowed the Beypore and Ponnani rivers. All the rivers originally had to run north or south because they could not cut the highland directly to the west, but at length a narrow gorge was cut by the Karimpuzha between Urakuthmalai and Pandalur through the highest part of the plateau and a tributary of the Beypore river found its way through this gorge and joined the Kadalandi river. The upper part of its course is at a lower level than the part of the plateau through which the gorge is cut.

The plain of marine denudation started from these islands as a centre. On other parts of the West Coast where there were no bays and no outlying islands, the plain probably started at the foot of the Western Ghats and grew outwards to the west. In those places, the plateau slopes from the Western Ghats to the coast.

The extent of ground occupied by the plateau laterite is considerable; it covers almost the whole of what is left of the plain of marine denudation and is found nowhere else. Examples of such occurrence are:—

- (1) to the north of Malappuram, a ridge running from the north-west to south-east between Urakuthmalai and Pandalur hills, the Cholera hills near the barracks being an outlying part of this ridge.
- (2) the high flat hills of Kuddocotta and Perindatry
- (3) the two little caps on the high summit near Perintalmanna about 600'.

All these are nearly of the same elevation, about 600'.

Between Elanculam and Vadakkanpuram, Ananghat hill and the hills of Cherplacherry, Marayamangalam, Trikkadiri etc., form another group of hills which are all of the same elevation

about 650'. There can be no doubt that they are the remains of what was formerly a broad plateau.

Lower in elevation than either of the preceding groups of hills and ridges are the lateritic caps between the Thuthapuzha and Ponnani rivers, e.g., Muthuthala, Nethirimangalam, Kawoo (5 miles N.N.W. of Pattambi), Ramgiri fort hill at about 550'. To the east of the town of Ponnani and to the South of the river near Tritala is a plateau about 350' in elevation. A well marked long band of laterite follows the course of the Ponnani from Palghat to Pattambi filling a shallow valley between two low gneiss ridges and the actual channel of the river is cut down to the gneiss below. Near Ottapalam on the north side of the gneiss ridge is another band of laterite which is curiously enough on the same level as the Ponnani laterite. The height of the Ponnani laterite at Mankara and Ottapalam is about 250' to 280' and the same general elevation is maintained further down the river, although the valley is much deeper.¹⁷

In some parts of Kerala, to the west of the laterite formations are found the Warkkalay beds,¹⁸ e.g. in the cliff edging the sea shore some 12 miles south of Quilon. The most characteristic bed of the Warkkalay formations is the lignite bed which is exposed at the base of the cliff at Warkkalay. It consists almost entirely of lignite in some places while in others it is replaced by a carbonaceous sandy clay of dark colour, often smelling of sulphur. The Warkkalay beds constitute the seaward edge of the plateau or terraced country and they present similar features,

17. This general elevation of 250 to 300 feet is very characteristic and very nearly corresponds to the 30 to 40 fathom limit of the Vazhappally coral reefs.

18. The Warkkalay beds have the following succession of strata:—

Laterite with sandstone masses	..	30' to 40'
Sand clay or lithomarge and sandy clay with sandstone bands	..	58'
Alum clays	..	25'
Lignite beds with logs of wood, etc.	..	7' to 15'
TOTAL	..	120' to 138'

The order of the succession of the beds is not constant.

bare grass grown, long flat undulations of laterite forming the higher ground 200' above the sea. They extend as far north as Kottayam bordering the back-water tract in the east and probably much further northwards as is evidenced by the lignite deposits in Cannanore and Beypore.¹⁹ Somewhat similar beds occur further north near Ratnagiri on the Bombay coast. The Warkkalay beds are without doubt aqueous in origin.²⁰

The marine lateritic terrace and the Warkkalay formation are probably of upper tertiary age and equivalent to the Cuddalore sandstones of the Coromandel coast—late tertiary or post-pliocene. They mark like the long stretches of laterite and sandstones on the east coast, the last great or decided elevation of South India prior to which, as is very probable, the Indian land rose directly from the sea by its Western Ghats and had an eastern shore-line which

19. Lt. Newbold describes the bank of the Beypore river near Beypore as made up of the following series of beds:—

Sandy alluvial soil	..	4'
Loose sandstone with beds of ochreous earth	..	10'
Gritty sandstone passing into gritty laterite	..	20'
Carboniferous stratum a few inches to	..	5'
	—	
TOTAL	..	39'
	—	

It has been suggested that these are representatives of the Warkkalay beds (*District Manual of Malabar*, page 21) but there is no proof that this is the case. "The banks of the river are partly marine and partly fluviatile deposits and irregular seams of lignite may be expected to occur in these." Vide *Memoirs*, G.S.I., Vol. 24, page 233.

The sinking of a well in Cannanore has brought out the following material:

Red earth and gravel	..	8'
Tough hard laterite	..	20'
Red and yellow clay	..	10'
Blue clay	..	10'
Carboniferous stratum, lignite	..	4'
White sand	..	4'
	—	
TOTAL	..	56'
	—	

20. Records of the Department of Geology of Travancore, Vol. I, p. 24.

is now indicated very well by the inner edge of Tanjore, South Arcot, Madras, Nellore and Godavari belts of lateritic sandstone.²¹

West of both the lateritic formations and the Warkkalay beds, occur along the coast, the recent deposits which are the usual blown sands and alluvial sediments of the low flat country, almost at sea level and marked by sandy and alluvial flats. These widen out north from Quilon until at Alleppey there is a width in excess of 12 miles with the very extensive backwater which stretches far past Cochin. This is continued further north through the Trichur lake, the Taliparamba and Valarpattanam rivers to those on the Kadaiundi river. To the south of Quilon and north of Calicut this formation occurs as a very narrow strip bordering the sea.

Immediately after the upheaval of the Warkkalay formations this backwater tract north of Quilon must have been an extensive bay²² breaking its waves on the dry land which now forms its eastern boundary. Into this bay were discharged the waters of the Periyar, the Pampa, the Chaiakkudi, the Ponnani etc., heavily charged with sediment resulting in the formation of a sand bank which is represented by the present sea coast north of Quilon. The lagoon formed between this sand bank and the mainland was gradually silted up to give rise to the wet paddy lands and cocoanut groves which now characterise this tract. The comparatively deep lagoons are only the remnants of those which have not been silted up. The marine nature of the formation is conclusively attested to, by the soil of the low-lying lands of the sea-coast consisting of sea sand and calcareous matter, combined with various kinds of earth and clay.

Based upon the type of the main rock formations like the laterites, the Warkkalay formations, and the recent sediments, it is thus possible to suggest that the region of Kerala has been lifted up from the sea probably in post-pliocene times. The remains of marine animals and plants found within the region almost conclusively confirm this suggestion.

The Literary and Historical evidence. Even in modern times large tracts of land have been formed on the coast by natural

21. Logan: *Malabar*, Vol. I, page 26.

22. The presence of coral reefs in Vazhappally near Changancherry is certainly conclusive evidence of the much wider extent of the sea in those

forces. The island of Vypin 13 miles long and 1 mile wide on the northern side of Cochin is said to have been thrown up by the sea in A.D. 1341. It would appear that prior to this, a small river flowed by the town of Cochin with only a narrow outlet for the discharge of fresh water that came in torrents during the rainy season down the Ghats, at the well-known opening at Cranganore, about 20 miles to the north of Cochin. In the year 1341, an extraordinary flood occurred which forced itself into the sea at Cochin and opened a capacious estuary converting the landlocked harbour into one of the finest ports in India. The island is known in the locality as Puthu Vaipu, i.e., new formation and the local people commence the era from A.D. 1341.

Places situated on the eastern shores of the backwater have peculiar names with a definite reference to the sea and an analysis of the place-names conclusively suggests that the sea-coast must originally have run along the eastern shores of the backwater tract. A few illustrations are cited below in support of this statement:—

About 8 miles to the north of Cochin, on the east side of the backwater lies the village of Kadakkara=Kadal+Kara or Sea+Shore i.e., sea shore. In close proximity to it is another village called Ezhikkara=Azhikkara or Azhi+Kara=Sea+Shore; again meaning sea shore. Just south of Ezhikkara is the village of Kadamakudi which means either the dwelling at the end (kada meaning end and kudi meaning dwelling) or the abode of the fisherman. (Kadakkodi means fishermen) also suggesting a coastal location. All these villages now lie at least 3½ to 4 miles inland. On the eastern side of the Vembanad lake almost in its centre lies the town of Vycom. Vycom is derived from the root Vekkuka i.e., to place or deposit. Close to Vycom in the south lies Vechur meaning alluvium. Vechur is also akin to Vypin and may be due to the recession of the sea. About 8 miles to the east of Vycom is Kadathuruthi=Kadal+Thuruthu i.e sea+island or an island in the sea. Midway between Trivandrum and Quilon lies Kadakkavur (kadal+kavu+ur) which clearly suggests proximity to the sea. Many more similar examples can be cited, all of them lying near the eastern shores of the backwater tract. These names thus suggest that the present coast is newly formed.

Megasthenes in the 4th Century B.C. mentions of a place by the name Tropina as lying on the sea coast.²³ Eminent scholars have identified it with Trippunithura; which in itself is a composite word formed of Tri+puni+thura i.e., Three+rivers+port in other words the port of 3 rivers. Whether Trippunithura be Tropina or not, it is clear that it was once a port and hence on the coast. Its present location is however four miles inland from the eastern shores of the backwater and more than 8 miles from the port of Cochin. The towns mentioned by Ptolemy as lying on the coast between Muziris and Barakare can nowhere be identified as the coast now stands, while some are probably to be found on the eastern shores of the backwater. Podoperoura is probably Udayamperur, Semne is Chembu, Bambala is probably Vembanad or the present Vembanad lake, and Cerevra is Chowerra. In a manuscript account of Malabar written in A.D. 1525 and quoted by Herman Lopez de Castaneda, it is said that a little more than 2300 years ago, the sea came upto the foot of the Western Ghats.²⁴

It has thus been shown that geologically there is a wealth of evidence to lead to the conclusion that the sea originally extended upto the Western Ghats, the historical and literary evidence already adduced lends added support to this conclusion. Kerala thus has been literally raised from the sea. The tradition of Parasu Raman having achieved this by superhuman powers is only the description of an apparently miraculous event in grand poetic style, with a considerable amount of embellishment.

"During the last glacial period, the sea level became markedly lowered, partly by the actual abstraction from the ocean of large quantities of water that were locked up in the polar regions in the form of ice, and partly by the mass attraction of these large ice masses, that drew a further quantity of water away from the tropical regions towards the poles." The sum of these factors caused a fall in sea level throughout the tropical belt that Daly conservatively estimated at 60 to 70 metres.²⁵ This very nearly

23. R. C. Dutt, *Ancient India*, Vol. 2, page 30 and Mrindle, *Ancient India* as described by Megasthenes and Arrian in note on page 142.

24. *Madras Journal of Literature and Science*, Vol. 22, pages 261 and 262.

25. *Field Sciences of India*, edited by Sundarlal Hora, page 26.

corresponds with the 40 fathom limit of coral reef growth at Vazhappally and with the general elevation of the laterite and Warkkalay formations—250'. Moreover geologists consider both these rocks to have been formed during the period of the great ice age.²⁶ It is thus probable that glaciation has been the main cause in bringing to light the regions of the lateritic and Warkkalay formations, but it is equally probable that the area still further west of these formations has been uplifted in much more recent times as is evidenced by the fact that it goes back to human memory and is treasured up even to-day in the form of legends.

26. *Field Sciences of India*, edited by Sundarlal Hora, Table of Geological Formations, opposite page 45.

The Simple Theory of Projections

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The following paper is neither a treatise on map projections nor an account of all recent projections. It is an attempt to show that all the important formulae for the three principal systems of projections i.e. Conical, Cylindrical and Zenithal can be easily established with the help of their fundamental properties without having recourse to the general theory of Gauss or the exhaustive derivations of Germain. It is therefore proposed to adopt the principle of a very distinguished topographer, that in a book on map projections intended for the mapmaker and the map user, "one should draw the line at the root of minus one" — a principle which has been adopted and strictly followed by Hinks in his 'Map Projections.' It would be noticed that the methods used in this paper are simple and do not involve higher mathematics.

Normal Conical Projections

In these projections the meridians are represented by straight lines converging to a point, the vertex and the parallels of latitudes by concentric circles. (Fig. 1).

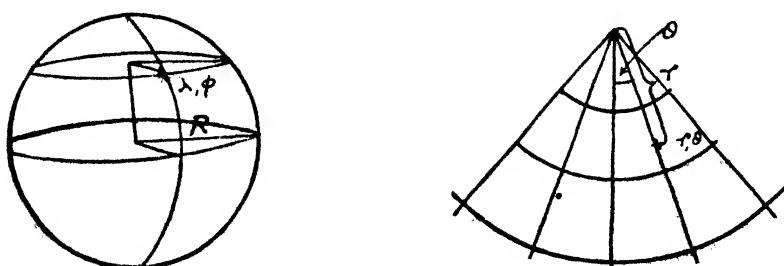


Fig. 1. The Earth (left) and its normal conical projection (right).

In what follows:—

R = the radius of the Earth (supposed spherical) expressed in the scale units of the intended map.

φ = the geographical or astronomical latitude.

λ = the longitude of a point on the Earth.

r, θ = the polar coordinates of a point on the map corresponding to λ, φ on the Earth. (As in the above fig.).

If the projection has one standard parallel i.e., one parallel which is shown in its true length upon the map,

r_0 = the radius of the standard parallel.

φ_0 = the latitude of that standard parallel.

χ = its co-latitude.

If the projection has two standard parallels.

r_1, r_2 = their radii.

φ_1, φ_2 = the latitudes of the two standard parallels.

χ_1, χ_2 = their co-latitudes.

n = the 'constant of the cone' i.e., the ratio $\frac{\delta\theta}{\delta\lambda}$

Before considering the projections in detail, let us consider the length of an element of the meridian λ on the Earth. It would be seen that it = $R\delta\varphi$. The corresponding length on the same element on the map = δr .

Hence the scale along the meridian is = $\delta r/R\delta\varphi$.

Similarly,

The length of an element of the parallel φ on the Earth is $R \cos \varphi \delta\lambda$.

The corresponding length on the map = $r\delta\theta$.

Therefore the scale along this parallel is = $\frac{r\delta\theta}{R \cos \varphi \delta\lambda}$

Hence for all normal conical projections the scales along the meridian and the parallel at a point r, θ on the map (corresponding to λ, φ on the Earth) are

$$\frac{\delta r}{R \delta \varphi} \text{ and } \frac{r \delta \theta}{R \cos \varphi \delta \lambda} \text{ respectively.}$$

Simple Conical (with one standard parallel).

In this projection:

- The cone is tangential to the globe and touches it along a given parallel.
- This parallel is called the standard parallel and is represented truly on the map i.e., the scale along the standard parallel is = unity.
- The parallels are their true distances apart i.e., the scale along the meridians is true (or in other words = 1 numerically).

From property (a) above it is clear that

$$r_o = R \cot \varphi_o \quad \dots \quad (1)$$

From (c) above we get

$$\frac{\delta r}{R \delta \varphi} = -1$$

(-1, because φ increases when r decreases. See Fig. 2.)

$$\text{or } \delta r = -R \delta \varphi$$

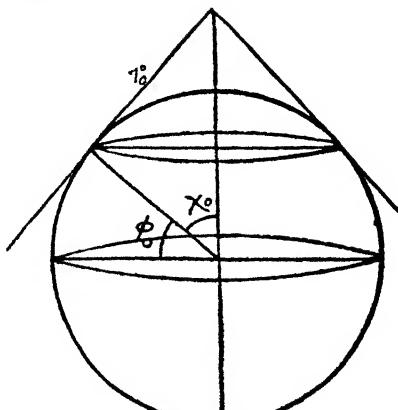


Fig. 2.

Integrating this equation we have

$$r = -R\varphi + A \text{ (a constant)}$$

but $r = r_o$ when $\varphi = \varphi_o$.

$$\text{Hence } r = r_o - R(\varphi - \varphi_o) \quad \dots \quad (2)$$

From property (b) above it follows that

$$\frac{r_o \delta\theta}{R \cos \varphi_o \delta\lambda} = 1$$

$$\therefore \frac{\delta\theta}{\delta\lambda} = n = \frac{R \cos \varphi_o}{r_o} = \sin \varphi_o \quad \dots \quad (3)$$

Simple Conical (with two standard parallels).

In this projection:

- (a) The parallels are their true distances apart, i.e. the scale along the meridians is true.
- (b) The standard parallels are of their true lengths i.e., the scales along these parallels are true.

From property (a) above

$$\frac{\delta r}{R \delta\varphi} = -1 \quad (\text{as in the previous case})$$

$$\text{or } r = -R\varphi + C \quad (\text{by simple integration. } C \text{ is a constant})$$

but $r = r_1$ when $\varphi = \varphi_1$

and $r = r_2$ when $\varphi = \varphi_2$.

$$\text{Hence } r = r_1 - R(\varphi - \varphi_1) \quad \left. \begin{array}{l} \\ \text{also } r = r_2 - R(\varphi - \varphi_2) \end{array} \right\} \quad \dots \quad (1)$$

From property (b) above:

$$\frac{r \delta\theta}{R \cos \varphi \delta\lambda} = 1, \text{ only when } r = r_1 \text{ or } r_2 \text{ and } \varphi = \varphi_1 \text{ or } \varphi_2$$

Therefore by integration:

$$\left. \begin{array}{l} r_1 \theta = R \cos \varphi_1 \lambda \\ r_2 \theta = R \cos \varphi_2 \lambda \end{array} \right\} \quad \dots \quad (2)$$

Equations (1) give $r_1 - r_2 = R(\varphi_2 - \varphi_1)$

Equations (2) give $\frac{r_1}{r_2} = \frac{\cos \varphi_1}{\cos \varphi_2}$

Therefore by eliminating r_2 from the last two equations we have

$$r_1 = \frac{R(\varphi_2 - \varphi_1) \cos \varphi_1}{2 \sin \frac{\varphi_2 + \varphi_1}{2} \sin \frac{\varphi_2 - \varphi_1}{2}} \quad (3)$$

Conical Equal Area with one standard parallel. (Lambert's fifth).

In this projection:

- (a) The area of an element on the map is equal to the area of the corresponding element on the Earth. See fig. below:



Fig. 3

- (b) The standard parallel is of its true length i.e., the scale along it is = 1 numerically.
- (c) The Pole is represented on the map by the centre of the concentric meridional arcs.

Condition (a) gives:

$$\frac{r\delta\theta}{R \cos \varphi \delta\lambda} \cdot \frac{\delta r}{R \delta\varphi} = -1$$

$$\text{Or } \frac{r\delta\theta}{R \sin \chi \delta\lambda} \cdot \frac{\delta r}{R \delta\chi} = 1.$$

$$\text{since } \varphi = \frac{\pi}{2} - \chi.$$

Substituting n for $\frac{\delta\theta}{\delta\lambda}$ we have

$$r\delta r = \frac{R^2}{n} \sin \chi \delta \chi.$$

Integrating this equation we have:

$$\frac{r^2}{2} = -\frac{R^2}{n} \cos \chi + C$$

Condition (c) gives

$$r = 0 \text{ when } \chi = 0$$

$$\text{Hence } \frac{r^2}{2} = -\frac{R^2}{n} \cos \chi + \frac{R^2}{n} = \frac{2R^2}{n} \sin^2 \frac{\chi}{2}.$$

$$\text{Or } r\sqrt{n} = 2R \sin \frac{\chi}{2} \quad (1)$$

Condition (b) gives:

$$r_o \delta\theta = R \sin \chi_o \delta\lambda.$$

$$\text{Or } nr_o = R \sin \chi_o \quad (2)$$

From (1)

$$\sqrt{n} r_o = 2R \sin \frac{\chi_o}{2}.$$

Since $r = r_o$ when $\chi = \chi_o$

$$\therefore \sqrt{n} = \cos \frac{\chi_o}{2} \quad \text{from (2)}$$

$$\therefore n = \cos^2 \frac{\chi_o}{2} \quad \dots \quad (3)$$

Substituting the value of n in (1) and (2) we have

$$r = 2R \sec \frac{\chi_o}{2} \sin \frac{\chi}{2} \quad (4)$$

$$\text{and } r_o = 2R \tan \frac{\chi_o}{2}.$$

Conical Equal Area with two standard parallels (Albers').

In this projection:

- (a) The area of an element on the map is equal to the area of the corresponding element on the globe. (Fig. 3).
- (b) The lengths of the standard parallels on the map are true i.e., the scales along these parallels are true.

From property (a) above it is clear that:

$$\frac{\delta r}{R \delta \varphi} \cdot \frac{r \delta \theta}{R \cos \varphi \delta \lambda} = -1$$

(-1, for reasons already mentioned)

$$\text{Or } r \delta r = -k R^2 \cos \varphi \delta \varphi + C$$

$$\left(\text{if we suppose that } k = \frac{\delta \lambda}{\delta \theta} = \frac{1}{n} \right)$$

C is a constant.

Integrating this equation we have

$$\left. \begin{aligned} r^2 &= 2R^2 k (\sin \varphi_1 - \sin \varphi) + r_1^2 \\ \text{and } r^2 &= 2R^2 k (\sin \varphi_2 - \sin \varphi) + r_2^2 \end{aligned} \right\} \quad \dots \quad (1)$$

since $r = r_1$ when $\varphi = \varphi_1$ and $r = r_2$ when $\varphi = \varphi_2$

From property (b) above:

$$\frac{r\delta\theta}{R \cos \varphi \delta\lambda} = 1 \quad \text{only when } r = r_1 \text{ and } \varphi = \varphi_1$$

$$\text{and } r = r_2, \varphi = \varphi_2$$

$$\text{i.e., } r_1 \delta\theta = R \cos \varphi_1 \delta\lambda \quad \text{and} \quad r_2 \delta\theta = R \cos \varphi_2 \delta\lambda.$$

$$\text{or } nr_1 = R \cos \varphi_1 \quad \text{and} \quad nr_2 = R \cos \varphi_2$$

Equations (1) give

$$r_1^2 - r_2^2 = 2R k (\sin \varphi_2 - \sin \varphi_1)$$

Equations (2) give

$$r_1^2 - r_2^2 = R^2 k^2 (\cos^2 \varphi_1 - \cos^2 \varphi_2)$$

$$= R^2 k^2 (\sin^2 \varphi_2 - \sin^2 \varphi_1)$$

$$\text{Therefore } k = \frac{2}{\sin \varphi_1 + \sin \varphi_2} \quad \dots \quad (3)$$

Conical Orthomorphic with one standard parallel.

In this case:

- (a) At any point on the map the scale along the parallel is the same as the scale along the meridian.
- (b) The standard parallel is represented truly on the map.
- (c) The cone is tangential to the globe along the standard parallel as in the simple conical one standard parallel.

(b) and (c) give

$$n = \sin \varphi_o = \cos \chi_o \quad \dots \quad (1)$$

$$r_o = R \tan \chi_o \quad \dots \quad (2)$$

as in the case of simple conical (with one standard parallel).

From property (a) it is obvious that

$$\frac{\delta r}{R \delta \varphi} = \frac{-r \delta \theta}{R \cos \varphi \delta \lambda}$$

(minus sign because r increases when φ decreases).

$$\text{Or } \frac{\delta r}{R \delta \chi} = \frac{r \delta \theta}{R \sin \chi \delta \lambda} \quad \text{since } \varphi = \frac{\pi}{2} - \chi \text{ (co-latitude)}$$

$$\text{Hence } \frac{\delta r}{r} = n \frac{\delta \chi}{\sin \chi}$$

Integrating the above equation we have

$$\log r = n \log \tan \frac{\chi}{2} + A \text{ (a constant).}$$

But $r = r_o$ when $\chi = \chi_o$.

Therefore

$$r = \left(\frac{r_o}{\tan \frac{\chi_o}{2}} \right)^n \left(\tan \frac{\chi}{2} \right)^n = m \left(\tan \frac{\chi}{2} \right)^n \quad (3)$$

$$\text{where } m = \frac{R \tan \chi_o}{\left(\tan \frac{\chi_o}{2} \right)^{\cos \chi_o}}$$

Conical Orthomorphic with two standard parallels.

In this case:

- At any point on the map the scale along the parallel is the same as the scale along the meridian.
- The standard parallels are represented truly on the map.

From property (a) above we have

$$\frac{\delta r}{R \delta \varphi} = - \frac{r \delta \theta}{R \cos \varphi \delta \lambda} \quad \text{since } \varphi = \frac{\pi}{2} - \chi \text{ (colatitude).}$$

$$\text{Or } \frac{\delta r}{R \delta \chi} = - \frac{r \delta \theta}{R \sin \chi \delta \lambda} \quad \text{where } n = \frac{\delta \theta}{\delta \lambda} = \text{a constant.}$$

$$= \frac{nr}{R \sin \chi}$$

$$\text{Hence } \frac{\delta r}{r} = \frac{n \delta \chi}{\sin \chi}$$

Integrating the above equation

$$\log r = n \log \tan \frac{\chi}{2} + A \text{ (a constant)}$$

But $r = r_1$ when $\chi = \chi_1$

and $r = r_2$ when $\chi = \chi_2$

Therefore

$$\left. \begin{aligned} r &= \frac{r_1}{\left(\tan \frac{\chi_1}{2} \right)^n} \quad \left(\tan \frac{\chi}{2} \right)^n \\ \text{also } r &= \frac{r_2}{\left(\tan \frac{\chi_2}{2} \right)^n} \quad \left(\tan \frac{\chi}{2} \right)^n \end{aligned} \right\} \dots (1)$$

From property (b) above it is evident that

$$nr_1 = R \cos \varphi_1 = R \sin \chi_1$$

$$\text{and } nr_2 = R \cos \varphi_2 = R \sin \chi_2 \dots (2)$$

$$(1) \text{ give } \frac{r_1}{r_2} = \left(\frac{\tan \frac{\chi_1}{2}}{\tan \frac{\chi_2}{2}} \right)^n$$

$$(2) \text{ give } \frac{r_1}{r_2} = \frac{\sin \chi_1}{\sin \chi_2}.$$

Equating and taking logs. we have finally

$$n = \frac{\log \sin \chi_1 - \log \sin \chi_2}{\log \tan \frac{\chi_1}{2} - \log \tan \frac{\chi_2}{2}} \quad \dots \quad (3)$$

Normal Cylindrical Projections.

Cylindrical Projections are limiting cases of Conical Projections when the constant of cone n becomes equal to zero. We would, however, develop formulae for these projections independently since they can easily be derived from their elementary properties.

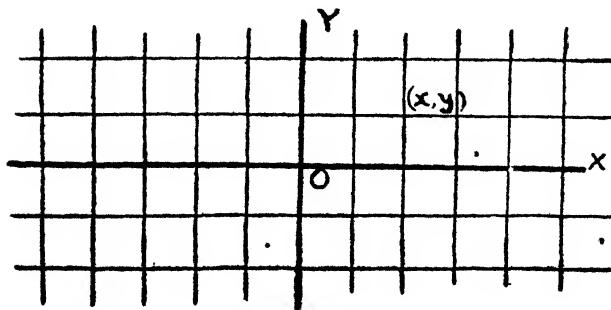
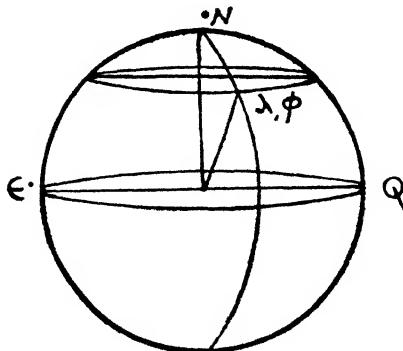


Fig. 4.

In fig. 4 the sphere and its cylindrical projection are shown clearly. A point λ, φ on the globe is represented by a point x, y . Co-ordinates in both cases are referred to the Equator (which is the x -axis on the map) and a standard meridian (which is the y -axis on the map). It is obvious from the figure that an element along a meridian λ on the globe (length = $R\delta\lambda$) is represented on the map by an element δy and that the corresponding length of an element $R \cos \varphi \delta\lambda$ along a parallel φ is δx on the map. In other words the scales at a point x, y on the map are:

$$\frac{\delta x}{R \cos \varphi \delta\lambda} \quad \text{along the } x\text{-axis}$$

$$\text{and } \frac{\delta y}{R \delta\varphi} \quad \text{along the } y\text{-axis}$$

Simple Cylindrical, 'Projection Plate Carré' or 'Quadratische Plattkarte'.

In this simple case:

- (a) The scale is true along the Equator.
- (b) The parallels are their true distances apart i.e., the scale along the meridians is true.

From (a) above it follows that:

$$\frac{\delta x}{R \cos \varphi \delta\lambda} = 1 \quad \text{only when } \varphi = 0$$

$$\text{i.e. } \delta x = R\delta\lambda \quad \text{since } \cos 0 = 1$$

Integrating this we have

$$\begin{aligned} x &= R\lambda + A & (\text{which} = 0 \quad \text{since } x = 0 \quad \text{when } \lambda = 0) \\ \text{or } x &= R\lambda \end{aligned} \quad (1)$$

From (b) it follows that:

$$\frac{\delta y}{R \delta\varphi} = 1$$

$$\text{Or } y = R\varphi + A (= 0) \quad \dots \quad (2)$$

The scale along the parallels is therefore $1/\cos \varphi$.. (3)

i.e. it increases as we move away from the Equator.

Projection Plate Parallelogrammatique.

In this projection:

- (a) The scale is true along a given parallel (say φ_0) and not along the Equator as it was in the above case.
- (b) The parallels are their true distances apart i.e., the scale along the meridians is true.

From (a) above

$$\frac{\delta x}{R \cos \varphi \delta \lambda} = 1 \quad \text{only when } \varphi = \varphi_0$$

or $\delta x = R \cos \varphi_0 \delta \lambda$

or $x = R \cos \varphi_0 \lambda \quad (\text{since } \varphi = 0 \text{ when } x = 0)$.. (1)

From (b) above $\frac{\delta y}{R \delta \varphi} = 1$

or by integration $y = R \varphi \dots \dots (\varphi = 0, y = 0)$.. (2)

The scale along the parallels is therefore, from (1)

$$\frac{\cos \varphi_0}{\cos \varphi} \quad \dots \quad (3)$$

i.e., it is true along the parallels φ_0 and $-\varphi_0$ and increases away from them towards the Poles. At the Equator it $= \cos \varphi_0$ and decreases towards it from the standard parallels.

Cylindrical Equal-Area Projection.

On this projection, as its name signifies:

- (a) The area of an element on the map is equal to that of the corresponding element on the sphere.
- (b) The scale along a standard parallel is true.

From (b) above we have

$$\frac{\delta x}{R \cos \varphi \delta \lambda} = 1$$

only when $\varphi = \varphi_o$ (where φ_o is the standard parallel)

$$\text{or } \frac{\delta x}{R \cos \varphi_o \delta \lambda} = 1$$

$$\text{or } x = R \cos \varphi_o \lambda \quad \dots \quad (1)$$

From property (a) it follows that

$$\frac{\delta x}{R \cos \varphi \delta \lambda} \cdot \frac{\delta y}{R \delta \varphi} = 1$$

Substituting the value of δx from (1) in this equation we have:

$$\delta y = R \frac{\cos \varphi}{\cos \varphi_o} \delta \varphi$$

or by integration

$$y = R \frac{\sin \varphi}{\cos \varphi_o} \quad (\text{there is no constant since } y = 0, \text{ when } \varphi = 0) \quad \dots \quad (2)$$

In the special case when $\varphi_o = 0$ i.e. the enveloping cylinder touches the sphere along the Equator the above equations become:

$$x = R\lambda \text{ and } y = R \sin \varphi \quad \dots \quad (3)$$

Cylindrical Orthomorphic Projection.

In this case:

- (a) The scale along the parallel is same as that along the meridian at any point on the map.
- (b) The scale along a standard parallel (say φ_o) is true.

Condition (b) gives

$$x = R \cos \varphi_0 \lambda \text{ as in the previous case} \quad \dots \quad (1)$$

Condition (a) gives $\frac{\delta x}{R \cos \varphi_0 \delta \lambda} = \frac{\delta y}{R \delta \varphi}$

Substituting the value of δx from (1) in the above equation.

$$\frac{\cos \varphi_0}{\cos \varphi} = \frac{\delta y}{R \delta \varphi}, \text{ or } \delta y = \frac{R \cos \varphi_0}{\cos \varphi} \delta \varphi$$

Integrating the above we have

$$y = R \cos \varphi_0 \log \tan \left(\frac{\pi}{4} + \frac{\varphi}{2} \right) \quad \dots \quad (2)$$

since $y = 0$ when $\varphi = 0$.

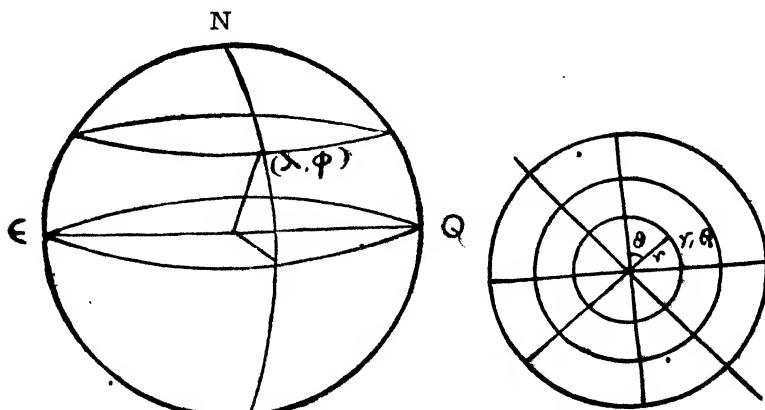
In the special case when $\varphi_0 = 0$ i.e. the enveloping cylinder touches the sphere along the Equator the above equation becomes:

$$x = R \lambda \text{ and } y = R \log \tan \left(\frac{\pi}{4} + \frac{\varphi}{2} \right) \quad \dots \quad (3)$$

This is Mercator's Projection.

Normal Zenithal Projections.

In these projections the meridians of longitude are represented by a set of straight lines radiating from a centre and the parallels of latitude are represented by a set of concentric circles described about this centre. The centre of the map corresponds with the Pole on the Earth. Fig 5.



Thus if r, θ (any point on the map) corresponds to λ, φ on the globe the scales along the meridians and parallels are, as before,

$$\frac{\delta r}{R \delta \varphi} \text{ and } \frac{r \delta \theta}{R \cos \varphi \delta \lambda} = \frac{r}{R \cos \varphi}$$

(since obviously for all normal zenithal projections $\theta = \lambda$)

Zenithal Equidistant Projection.

In this projection, in addition to the properties mentioned above which apply to the whole family of Zenithal (normal) projections, one more condition is satisfied viz., the scale along the meridians is true.

This last condition implies that:

$$\frac{\delta r}{R \delta \varphi} = -1 \quad (\text{since } r \text{ increases when } \varphi \text{ decreases})$$

Integrating we have

$$r = -R\varphi + C \quad C = \frac{\pi}{2} \cdot R.$$

$$\text{because } r = 0 \text{ when } \varphi = \frac{\pi}{2} \quad \therefore \quad r = R \left(\frac{\pi}{2} - \varphi \right) = R\chi$$

The scale of areas is therefore $-r/R \cos \varphi$ or $\varphi - \frac{\pi}{2} / \cos \varphi$

This projection is neither orthomorphic nor equal-area.

Zenithal Equal-Area Projection.

In this case the areas are truly represented on the map. Therefore

$$\frac{\delta r}{R \delta \varphi} \frac{r}{R \cos \varphi} = -1 \quad (\text{since } r \text{ increases as } \varphi \text{ decreases})$$

$$\text{or } r \delta r = -R^2 \cos \varphi \delta \varphi.$$

Integrating as before

$$\frac{r^2}{2} = -R^2 \sin \varphi + C \quad \left(C = R^2 \text{ since } r = 0 \text{ when } \varphi = \frac{\pi}{2} \right)$$

$$\text{Therefore } r = 2R \sin \frac{\chi}{2} \quad \left(\text{since } \varphi = \frac{\pi}{2} - \chi \right)$$

Zenithal Orthomorphic Projection.

In this case it is evident that:

$$\frac{\delta r}{R \delta \varphi} = \frac{r}{R \cos \varphi} \quad \text{or} \quad \frac{\delta r}{r} = \frac{\delta \varphi}{\cos \varphi}$$

Integrating the above equation we have

$$\log r = \log \tan \left(\frac{\pi}{4} + \frac{\varphi}{2} \right) + A$$

$$= \log \tan \frac{\chi}{2} + A$$

$$\text{or } r = m \tan \frac{\chi}{2}. \quad (m = 2R \text{ when } r = 0 = \chi^*)$$

$$= 2R \tan \frac{\chi}{2}$$

*The value of m may be determined as follows:

If r_o is the radius of the standard || whose colatitude is χ_o .

$$\text{then } r_o = m \tan \frac{\chi_o}{2}.$$

$$\text{also } r_o = R \sin \chi_o \quad (\text{since the scale along this } || \text{ is true})$$

$$\text{Therefore: } m = 2R \cos^2 \frac{\chi_o}{2}.$$

This gives $m = 2R$ when $\chi_o = 0$.

Oblique Cylindrical Projections.

In the normal cases given above we have supposed that the x -axis on the different cylindrical projections represents the Equator on the reduced earth i.e. the enveloping cylinder either touches the sphere along the Equator or its axis coincides with the earth's polar axis. If, however, the x -axis on the map represents any other great circle on the sphere the projection is oblique or transverse. Such projections may be made to possess other properties also—for instance they may be simple, parallelogrammatic, equal-area, orthomorphic etc., as in the case of the normal cylindrical projections. Formulae for their construction may be derived very easily by simple transformation of coordinates as follows:

Suppose we decide to develop a cylindrical projection with reference to a great circle on the sphere whose pole is λ_0, φ_0 .

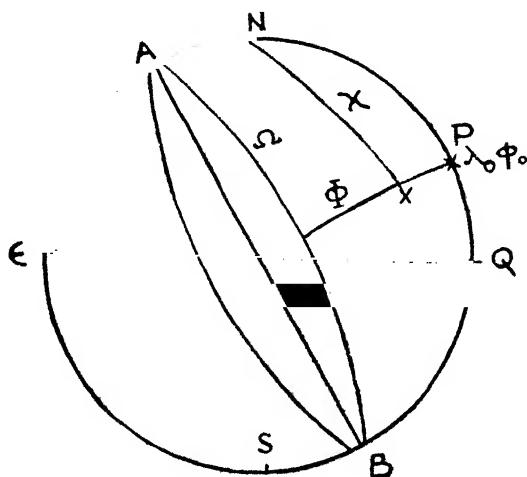


Fig. 5.

Let X be any point on the sphere whose coordinates with reference to the Equator are λ, φ and those with reference to AB are Ω, Φ

(Ω is measured from AP i.e. the meridian of λ_0, φ_0).

In the spherical triangle NXP

$$NP = \frac{\pi}{2} - \varphi_o; \quad NX = \frac{\pi}{2} - \varphi; \quad XP = \frac{\pi}{2} - \Phi$$

$$XNP = \lambda_o - \lambda; \quad NPX = \Omega$$

Therefore:

$$\cos XP = \cos NP \cdot \cos XN + \sin NP \cdot \sin XN \cdot \cos XNP$$

or

$$\sin \Phi = \sin \varphi_o \sin \varphi + \cos \Phi \cos \varphi_o \cos (\lambda_o - \lambda) \dots (1)$$

and

$$\frac{\sin NPX}{\sin NX} = \frac{\sin XNP}{\sin XP}$$

or

$$\sin \Omega = \cos \varphi \cdot \sec \Phi \sin (\lambda_o - \lambda) \dots (2)$$

From (1) and (2) above the corresponding values of Ω , Φ for any point λ , φ can be calculated if λ_o , φ_o is given.

Transverse Simple Cylindrical Projection.

In this projection the cylinder touches the sphere along a great circle whose pole is λ_o , φ_o . It is analogous to the simple normal case with the exception that λ , φ on transformation become Ω , Φ . Therefore in this case.

$$x = R \Omega \quad \text{and} \quad y = R \Phi$$

where Ω and Φ are functions of λ_o and φ whose values are determined from equations (1) and (2) above.

Cassini's projection is a special case of this projection. The cylinder touches the sphere along a meridian and a given point on it is the centre of projection.

Supposing λ_1 , φ_1 is the selected point. The pole becomes $\lambda_1 + \frac{\pi}{2}$, 0.

Substituting these values for λ_o φ_o we have from (1) and (2):

$$\sin \Omega = \cos \varphi \cdot \sec \Phi \cos (\lambda - \lambda_1)$$

and

$$\sin \Phi = \cos \varphi \cdot \cos \left(\lambda_1 + \frac{\pi}{2} - \lambda \right) = \cos \varphi \cdot \sin (\lambda - \lambda_1) \dots (1)$$

which on the elimination of Φ give:

$$\tan \Omega = \cot \varphi \cos (\lambda - \lambda_1)$$

but Ω is measured from λ_1 φ_1 which means that Ω becomes

$$\Omega - \frac{\pi}{2} + \varphi_1$$

$$\cot (\Omega + \varphi_1) = \cot \varphi \cos (\lambda - \lambda_1) \dots (2)$$

It is unnecessary to say that the two equations given above can be obtained directly without reference to the general formulae developed here.

Oblique Zenithal Projections.

In these projections:

- (1) A given point on the earth (say λ_o φ_o which is not the pole) is the centre of the map.
- (2) A set of great circles on the globe passing through a fixed point λ_o on the map is represented by a set of straight lines radiating from this centre.
- (3) The corresponding system of small circles on the globe, at right angles to the system of great circles mentioned above, is represented by a set of circles described about the same centre.

As before let φ_o λ_o be the latitude and longitude of the chosen centre; φ , λ of any other point. And let ζ , θ be the angular distance and azimuth of this latter point from the centre (see fig. 7). Then from the spherical triangle NPX we have;

$$\cos \zeta = \sin \varphi_o \sin \varphi + \cos \varphi_o \cos \varphi \cos \lambda - \lambda_o \quad \dots \quad (1)$$

and

$$\sin \theta = \cos \varphi \operatorname{cosec} \zeta \sin \lambda - \lambda_o \quad \dots \quad (2)$$

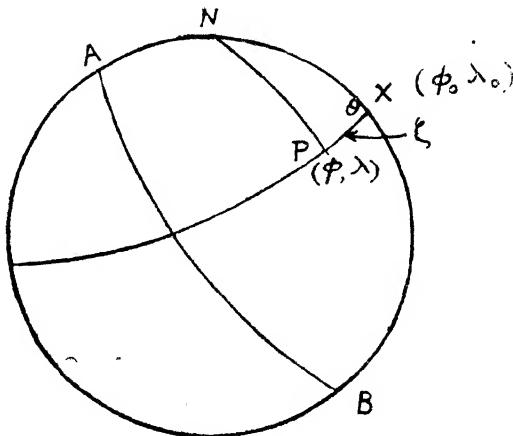


Fig. 7.

Thus the original formulae for normal zenithal projections become on transformation

$$r = R \zeta$$

$$r = 2R \sin \frac{1}{2} \zeta$$

$$\text{and } r = 2R \tan \frac{1}{2} \zeta$$

where the values of θ and ζ are computed from equations (1) and (2) given above.

Geography and Culture

By

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India is in agony to-day with the rest of the world. All its politics and its ancient philosophy have been of little avail. There is unrest in almost every corner of the country. Notwithstanding the progress of scientific research at the Universities and other centres, there are failures and shortcomings of all sorts, and communal riots burst out now and then. No proper solution of this problem has been offered by our men of Science, and Education at the various centres has created more breaches and isolations between man and man, and the unification of the peoples, who inhabit this mighty sub-continent, has been delayed. In the present paper I have tried to point out the great importance of Geography as an aid to the unification of India's cultures, taking the example of the Indus Valley for the purpose. It has been established that cultures flow along certain natural channels from one physiographic region into another and that the process of acculturation depends to a great extent on geographical factors, e.g. water, climate etc.

Cultural aspects of History neglected

'History makes man wise.' But in our case, all historical teaching has not in the least enhanced the wisdom of the Indian Rishis. On the other hand it has made us more and more sectarian, more and more clannish and provincially biassed. The reason for this has been correctly given by G. S. Sardesai in one of his recent articles: "Students of history are usually so much attracted by political and administrative details that they tend to neglect entirely the cultural aspect of past events in their varied implications and changes, not only from age to age but particularly between one province and another."¹ To establish the 'essential unity of Indian

1. "Inter-Provincial Exchange of Culture during Maratha Times."—G. S. Sardesai, *Modern Review*, May, 1941, page 514.

culture,' it is now absolutely necessary to emphasise this aspect of Indian history. Again, in a scientific study of India, it will be also necessary to note that there can be no man-made boundaries of culture but only natural frontiers forming 'natural' regions, which belong to the domain of Geography. In other words, it is necessary to discover the unifying effects of land, climate and other natural environment in a region; for surely, in a study of 'natural' regions with all their natural relations and free Communications, at least the idea of hostility is excluded. Furthermore for the unification of the cultures of different regions, there must be a happy exchange of the material and moral wealth of every one of them. Geography, therefore, should not only be a handmaid of history but should form its fundamentals to produce better and healthier effects. Truly speaking, "the pernicious method of studying history in provincial and racial compartments" must be abandoned and a kind of All-India outlook, based on our natural environment and physical factors, must be adopted. There must be, in a land of such prodigal diversities, no 'provinces' in history but 'natural physiographic regions' for our study. The banks of our great rivers, the sides of our majestic mountains and magnificent plateaus and the shores of the wide oceans are the limits, though not insurmountable, of the cultures that prevailed in different parts of our country. Consequently, instead of calling a culture Punjabi or Bengali, it is now possible to call it Indus culture or Ganges culture, as the case may be. And more than this, the influences and complex relationships between the physical features and human activities should not be lost sight of, if we have to develop a comprehensive All-India outlook of Indian life in the past and adjust our life accordingly in the present times. This is a point which must also be considered by the newly formed Bharat Itihasa Parishad, now sitting at Benares. It is, therefore, that we emphasise the need of geographical training as an aid to the cultural unity of India and the unification of India's varied cultures. For, Mrs. Sarojini Naidu has truly said, "Not out of quarrels, not out of vulgar frictions of political conflict; not out of anything that means disharmony or isolation but out of the common heritage of both the Hindus and Moslems our Indian culture is born." Even the foreign invaders of Hindustan settled down in the country and, having added fresh stimuli to the old, caused a fusion and a coalescence of culture which is indivisible and which ultimately shapes into civilisation. Moreover, it can be said with confidence that the different physiographic regions of India, have produced the different

cultures peculiar to the natural conditions prevailing in them for the life of man. Not only material welfare but also racial features and cultural development are largely dependent upon such natural and physical forces. The physical factor cannot therefore be ignored. It must be our duty to see that the various Indian cultures, locally formed, get properly fused, so that it would be easier for us to create the greater Indian (All-India) civilisation, understanding and respecting all. Civilisation resolves itself into three factors, *viz.* Nature (i.e. geography), Man (i.e. history) and human experiences (i.e. cultures born of contacts). All, these have to be considered by us. At the same time in a country like ours with its veritable continent of peoples, its diversity of natural resources and environment, its 222 languages and 700,000 villages; it is futile to destroy this diversity for securing the desired unity. Sir Denys Bray, Ex-foreign Secretary, Government of India, said in a B.B.C. talk only recently: "It would be a poor day for India, if she allowed her passion for uniformity to obliterate her diversity, and I for one long to see Indians try their hands at building up a unity, native of Indian soil which will give scope to the realisation of India's diversity of riches." In other words, it is possible to unite India not by any harmful propaganda of intercommunal marriages or any such unnatural means, but by a well-thought-out programme of education, which should take account of the common element of cultures belonging to the major classes of people. It is also possible to evolve a common language for India in like manner.

Unification of India's Varied Cultures

Thus, Indian cultures are like oases in the vast desert of human barbarism. It is our task to unify these by a process of irrigation, causing a happy mingling of their spiritual waters in order to create a united, strong and peaceful nation, without losing the individuality of each. It is possible that the customs and rites of certain minor castes and tribes in India can be so obliterated in the process of social absorption that they may be easily eliminated from the country, as they are.²

To create internal peace in our country, it is necessary to destroy communalism by establishing a common house of culture, for

2. *Science and Culture*.—"The Hindu Method of Tribal Absorption" by N. K. Bose, Vol. VII, No. 4, p. 188,

us all. In the seeming differences of our languages, customs, manners, modes of worship and daily life, there must be sought that essential unity, born of healthy contacts and regional influences one upon another, e.g., Hindus living among Muslims in the Frontier environment for centuries are changed in their habits and manners as it suits them but without losing their racial individuality. For culture to be healthy, it must not be static but dynamic, not rigid but fluid, crossing the man-made boundaries in a natural manner, a thousand times over, and not remaining stagnant within water-tight compartments. Even for the purposes of a Federated India, Sir Sikander Hyat Khan's scheme of dividing India into certain zones can be improved upon by geographers and the difficulty of bringing into the Federation all British-India Provinces and the Native States (all man-made compartments) can be solved on the natural and regional basis.³

Geographical Approach to History of India

Thus all historical teaching and research need a scientific (geographical) background. There must be a geographical approach to the history of any place, of any period and of any people. If chronology is one eye of history, geography is the other. How events happen and how achievements take place can be seen from the influences of geographical environment and natural surroundings of man. Besides, it must be noted that natural environment never remains the same. It is not correct to say that nature is static while culture is dynamic.⁴ There is now developed a new branch of geography, called geo-morphology, which is quite appropriate. Nature ever changes and with it the doings of man change even in the same region but at different times and in different ages. Hence the changes in the geographical value of particular regions. With the growth and evolution of natural environment, there has been the growth and evolution of many a human settlement in the world.

Effect of Changing Circumstances

Changing surroundings change the life and character of man to a certain extent, whatever he may desire otherwise. At the

3. Vide my "Physiographic Divisions of India," 1940. *Jour. Madras Geog. Assn.*, Vol. XIV, No. 4, p. 434.

4. *Modern Review*—"Civilisation" by R. K. Das, July, 1941, p. 36.

same time man is capable of making some adjustments to surroundings, stable or unstable. Such an *investigation of the complex-relationships between man and nature* is within the sphere of geography. It is the study of this subject called Historical Geography that has been long neglected by our Indian Universities. It is high time that this mistake is corrected and attempts are made to interpret the past through a study of the present conditions of the earth, that is, geo-morphology.

Why Science is Failing

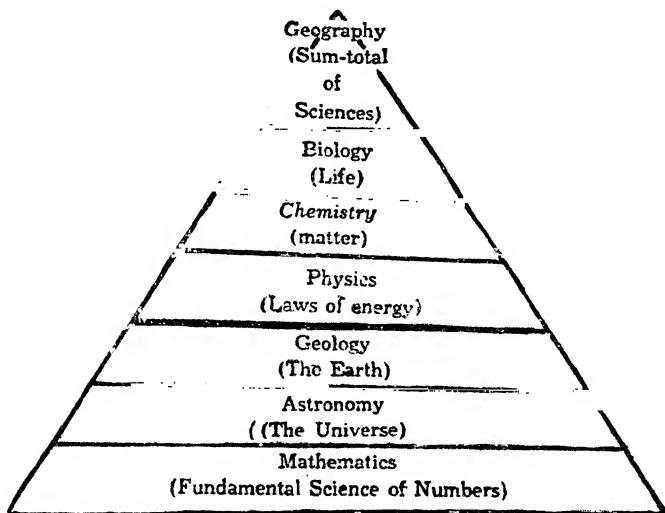
As stated above, the more science man learns the more cruel and savage he tries to be. The present European war has been proving this for us a second time. In many of our Indian Universities, the study of the fundamental sciences has greatly advanced, but in the social sciences we are lagging behind. Tremendous progress has been made in the physical and chemical sciences. Even the highest science degrees are now freely awarded to Indian researchers at many centres of learning. Discoveries of some consequence have been made, but what is the benefit to humanity? They have not reduced the poverty of India nor alleviated the sufferings of our people to any extent. Rather the racial intolerance, bitterness and rivalry have increased even among the scientists themselves. It was Sir Jagdish Chandra Bose who said that the discoveries he would make in his Institute would be the property of the whole world. But among our Indian scientists to-day there is a tendency to hide what they have found, to refuse to offer co-operation or collaboration to exchange their wares or to compare notes in any manner.

Synthesis of Scientific Research Needed

What is this state of affairs due to? It is because the most synthetic of sciences, *viz.*, geography, is left in the background. Matter has much advanced but not spirit. Physicists have fathomed the atomic world, chemists have analysed many drugs, geologists have peeped into the past epochs of the earth, and biologists have tried to understand the working of the human body; but there are few who have put social values on all these researches and tried to know why and how man behaves in a particular region and in a particular manner, and how and why a particular natural region has affected the whole progress of the people

and their settlements. So where other Sciences leave off, geography must begin. Geographical science will easily offer an explanation of what has happened in the prehistoric or historic past. That physical problems are closely connected with historical and sociological problems cannot now be denied. More than folklore, legendary data, even numismatic or archaeological evidences, it is the geographical landmarks that should be valuable to historians and sociologists, *viz.*, river terraces, lake levels, silting and alluviation, deflection of lakes, vagaries of rivers, etc.⁵

The following diagram will show the values of the various branches of science and the right position of geography in the evolution of human knowledge:



PYRAMID OF KNOWLEDGE

Other Uses of Geography

Thus it is easy to understand how precious the knowledge of geography is for the welfare of human beings and what an important position it should occupy in any scheme of education or scientific culture. As geography synthesises scientifically the findings of

5. Presidential Address: D. N. Wadia, 2nd Indian Cultural Conference, Calcutta, held under the auspices of the Indian Research Institute, p. 82.

other sciences, it gives a complete picture of a country. Even geographers have to help our economists to keep their feet properly on the earth. It was Henslow who persuaded Darwin to attend lectures on Geology, which was helpful to him in making such a far-reaching and wonderful discovery, as the survival of the fittest and the law of evolution. Similarly this much neglected science of geography is a panacea for the evils that prevail in the world. It would at least help in making people broad-minded and sympathetic.

The present deplorable condition of the world is to a great extent due to the ignorance of geographical knowledge. Even the present war has taught the whole world more geography than any other things could do, so that it can be said that "the chief use of war is to teach people geography." Upon the right knowledge of the various parts of the world and the nature of the environment, in which man is placed within it, depends the success or failure of any operations, on land, sea or in the air. It is, therefore, high time geography is introduced as an important part of the military science. All nations must make their defence preparations based on the geography of their lands. Unfortunately for our country, our students are kept painfully ignorant of these vital factors and Government is apathetic in this respect. For India particularly, geography must be of far more importance to them than other subjects, because the present position of world affairs shows an ever increasing interdependence of one nation upon another, an ever-growing necessity to know the character and aspirations of the peoples. And our country must be recognised as an important nation by all.

The map of Europe is fast changing. What Europe also needs badly is *collective security* under a more powerful League of Nations and *indivisible peace* without any human hatred or fear of war. These cannot be attained without a proper understanding of the ideals of all the nations and without removing the colour or caste restrictions. And our India must be a powerful member of such a League.

Happy Mingling of Cultures should be the Aim

The more we know about each other's outlook on life, based on environment, the better it is for all, as the more likely we are to come to an amicable understanding and friendly relationship. The same is true of all inter-provincial and inter-communal relations

in a country. Contact of cultures in a congenial natural environment is likely to unify our diverse customs, languages, creeds and castes more than anything else. The Law of Assimilation helps the process everywhere. A good example of such a mingling of cultures in a congenial region is that of Javanese civilisation. "We find here," says Dr. A. A. Baker, who accompanied Dr. Rabindranath Tagore to Java and Bali in the Netherlands Indies, in 1927 on a study tour, "a people who having been under the influence of a different culture for a period of centuries have been able to absorb congenial elements of that foreign culture to such an extent that the mass of the population is completely unconscious of the fact that there has been any foreign influence at all."⁶ In the Sanskrit origin of geographical and other proper names of the East Indies, in the various inscriptions of the Kings who ruled in Java, in the veneration of migratory gods, Shiva, Vishnu, Arjuna etc., in the services rendered by Javanese and Sumatran centres of learning to Buddhism, and even in the present population professing Islam but taking pride in ancient Hindu ideals, there are clear proofs of the fundamental influences of Hindu tradition on the culture of Indonesia. Such foreign cultural influences prove a nation to be strong and great, for, well has Tagore said. "Only the weak are afraid to borrow, because they know that they will not be able to pay off their debt in their own coin."

Similar is the contribution of ancient Zoroastrian culture to the civilisation of India through Parsee settlements in the northern and western provinces of India for well-nigh fourteen centuries e.g., Pataliputra and Bombay.⁷ Other Indian communities measure their strength by their numbers in millions but the Parsees measure theirs by their pure faith and spirit and by their world-known cosmopolitan charities made as religious duties. One of the best and concrete examples of a happy combination of Hindu and Moslem artistic culture is that of the Kutub Minar at Delhi. Here we find a distinct fusion of Hindu craftsmanship and Moslem style, something like a Saracenic modification of the Indian Jayasthamba (victory tower). Dr. N. Chatterjee of the Lucknow University says: "To the lover of Indian architecture, the question whether the Hindus or the Moslems built the Minar would appear wholly

6. *Illustrated Weekly*, Times Press, 1941, August 17, pp. 36, 46.

7. Vide my "Contribution of Gathic Culture to Indian Civilisation," Rethesbar, 31st Aug. 1941.

immaterial; for this great tower is a monument to the genius of the Hindus and the Moslems alike.”⁸

But to prove our thesis, more thoroughly let us take the example of Sind,—The lower Indus valley,—as a natural(physiographic) region, which has played a valuable part in the evolution of the Afrasian belt of civilisation and also served India as an antechamber for its passage of cultures through the valley and their spread into other parts of India. It is difficult to do full justice to the subject in a limited space, but we shall deal with a few important points to show how much our Indian civilisation owes to the historical geography of the “provinces” and how much more we can do in the present times for the *unification of our diverse cultures* by breaking the provincial boundaries and setting up others of an elastic kind, to produce a civilisation in which innocent nature and natural surroundings should play a vital part with the help of man.

Many Contributing Forces

Civilisation ensues where the struggle between man and nature for a civilised life is great. The environments of the atmosphere, hydrosphere, lithosphere and even biosphere act as powerful forces working around man and help or hinder him to make progress in life. Such natural surroundings were very suitable for human civilisation in Asia, which is indeed its home. Here man received good stimuli for his material, moral, and spiritual evolution. But properly speaking it is the belt, now known as the Afrasian steppe-desert belt,⁹ which is responsible for the various contributing *cultures*. It embraces such congenial natural regions as the Nile valley, the Aegean islands, the Jordan valley, the Euphrates-Tigris valley, the Iran plateau, the Caspian-Aral basin, the Indus valley, the Gobi region and the Yangtse valley. All these regions produced cultures peculiar to their soils and climates and all of them contributed to one another to produce human civilisation, off-shoots of which have found their shelters in the different parts of the world to-day.

The Afrasian Belt of Civilisation

Asia is a peculiar land of great elevation and conveniently flat, grass-covered depressions. It is, therefore, that there are formed,

8. *Indian Review*, September 1941, p. 552.

9. “The Geography behind History”—W. G. East, London, 1938, p. 155.

in it, isolated regions, which were congenial to human occupation and culture age after age. These centres of culture—Egyptian, Cretan, Chinese, Chaldean, Babylonian, Persian, Greek and Indian,—rose and fell one by one. Here in Asia as the natural forces went on working, sometime and somewhere in the Euphrates-Tigris valley, even the Garden of Eden was located and here again in some suitable epochs of human history, one after another the prophets came, beginning with Lord Zarathushtra who was the first in Iran to conceive the idea of unity in nature and oneness of God and the first to give a moral tone to religion.

Here in these trying regions, these prophets came to make man's life happy. The problem of problems for mankind always is food and water. Where they could be found in abundance for the time being, the lands were occupied one by one. From the food-hunting stage on the plateaus, when man reached the food-producing stage of civilisation in certain valleys, a distinct progress was made by him. Where he found flint, fire was discovered as a result of an accidental clash of the stones. This was a beginning of the Stone Age. Where metals were found in the rocks, one by one of the different ages of copper, bronze and iron came. When land was sufficiently watered by rain or river in a valley, cultivation was started. Wherever such waters could be artificially carried to convenient distances, canals were made and irrigation done,—a distinct advance in civilisation; and lastly communications were established to carry the food products from one place or region to another. In all these operations, it is established by modern geographers, the steppe-desert belt was more favoured by nature than other parts. Subsequent desiccation and accumulation of sand made even some of these regions unbearable and migrations took place.

It is at *some critical time in the evolution of this belt* that the Indus valley came into its own and wave after wave of human beings migrated through the available mountain passes and settled here. Not daunted but rather stimulated by any natural barriers and obstructions, the settlers in the valley all struggled, and by their creative powers and ability to adapt themselves to the environment, produced a new 'civilisation, which was the result of a fusion of local cultures with congenial foreign elements from neighbouring lands.

Contribution of Sindhian Culture to India's Civilisation

Here in the lower Indus valley,—itself a great gift of the sacred Sindhu,—were pooled together the experiences and inventions of a number of human races in order to produce such a civilisation. Let us first consider the physical factor which has contributed to it.

Geographical Control in the Indus Valley

In search of more grass, food and water supply, here man came and settled from very early times. (Witness Mohenjo Daro 2700 B.C.). Here he made efforts to understand the regime of the great river, to control its periodic floods, to erect bunds, to survey and cultivate the flooded areas and to make the best use of the leisure hours.

Like Egypt, Sind too became "a mother of mechanical arts."¹⁰ Here the soil was systematically renewed by nature herself, by means of the silt carried by the river every season. Fertility and productivity were maintained thereby. The rhythm of crops and daily life was produced, the inundations being good stimuli for labour in the fields. On such a fertile plain there were good chances for peaceful settlements or colonies which grew on both of its banks, and the river remained as a unifying factor. It helped to unite the interests of the cultivators to whichever class of religion or society they belonged. Thus a single government dispensing singular justice was established for controlling the supply of water at different places and for different seasons. Co-operation was for the same reason willingly given. Deprived by nature of older rocks and precious minerals, Sind had to communicate and trade with distant parts of Asia to import them for her progress. Up and down the Indus, the people moved to carry their goods; there being no rapids, as the valley here is in an aggraded state, there was no serious barrier to travelling and communication. The land gradient is low and so the canals could be cut in any direction and to any distance, e.g., the Rohri canal, cut from the Indus as a part of the Barrage project, is over two hundred miles, and passes through very barren districts.

Sind forms the lower flat-valley plain of the Indus lying between two barren areas, the Khirthar mountains and the Rajputana

10. "The Geographic Factor"—R. H. Whitebeck & O. J. Thomas, New York, 1932, p. 240.

desert. The soil is rich and the river delta is a growing one in the valley. The climate is hot and dry in summer with very little humidity. The region lies in a critical corner of India, almost on the border of the tropics and the temperate zone. All this makes agriculture an ideal profession in this valley with no danger or loss of arable land, with the prospects of the growth of natural vegetation belonging to both the zones. It is, so to say, the half-way house for both kinds of vegetation to take root and grow."¹¹

This is the result of man's "well-directed and concerted efforts to adopt and exploit the natural resources." Sind is a good example of a comparatively small but partially protected plain. Its mountain barriers are good and the desert segregates it further from other enemies. They help it to develop its individuality.

Virtue of Obstacle

At the same time nature has put certain obstacles in the life of man in this region. The mountain barriers were not complete and through the few but convenient passes as well as from the sea coast came marauders and others from time to time and disturbed its peace. No definite frontier policy could be fixed by Government for this reason. The climate was rigorous, very hot in summer though cold and bracing in winter with very little and variable rainfall. These made the people hardy but dependent on chances and fatalistic. The bed of the river in Sind is generally higher than the surrounding country. This caused the floods to rush into the country and to destroy the fields suddenly. The people had perforce to be vigilant and gain mastery over these destructive forces. The majority of the ancient cities were probably destroyed by such floods e.g., Mohenjo Daro. Underneath the sand and clay they are buried with the precious treasures strata by strata, which now archaeologists can well excavate for the benefit of our modern historians. What better proofs and data could we furnish in Sind than these buried cities,—thanks to the destructive powers of these floods? The river delta is growing continuously and so the distributing branches are changeful. There is no permanent channel and therefore no permanent settlements are possible within the delta or on the uninviting mangrove swamps of the coast line. The changeful river itself swings widely through

11. Vide my *A Geographical Analysis of the Lower Indus Basin*, Parts I, II and III.

a territory nearly 30 miles on either side and its bed is constantly changing with no towns permanently fixed on its banks, except one or two on rocky promontaries, e.g., Sukkur—Rohri and Sehvan. The underground water-table is also unstable from season to season and from one end of the region to the other. Wells, dug deep for water, are therefore unreliable.

In the Thar-Parkar and neighbouring areas a whole river,—the Hakra has dried up and left the land barren, only to be re-watered by the Nara canal in recent years. In summer, the solar heat is intense and the very houses of the inhabitants are made to rotate, so to say, to face the windy direction e.g., windsails of Hyderabad. In such a dry land the scarcity of domestic animals is also greatly felt. But this very circumstance has forced the people to take care of such crude creatures as the donkey and the wild horse, as best as they can. The camel, however, is the greatest discovery of the desert—an excellent example of adjustment to environment for food and water. So in such a semi-desert condition, man got an opportunity to evolve himself well to whatever community he belonged at the outset. Human ingenuity had to be constantly exercised here and such virtues as self-preservation, industry, courage and endurance were developed, and human perfection was attained thereby.

"It is the unfavourable conditions themselves," says Professor Jean Brunhes, "that determine the perfection of the human establishments. The effort that man puts forth to exploit the land is a factor both in what he wishes to do and in the difficulties which the land imposes upon him. The more difficult and refractory the earth shows itself, the more this ingenuity. Under the direct influence and the pressure of imperious necessities, man sometimes succeeds in attaining a rare degree of perfection."¹² Indeed in Sind the natural forces were powerful and varied: they could produce a fusion of cultures of a very high order on that account.

Clash of Cultures in the Region

With the periodic desiccation of the Iran plateau and the growth of sand, the people, who could not get sufficient water, food or space escaped through the mountain passes and caused havoc and destruction for the time being. From the early prehistoric times the Chalcolistic culture penetrated into the valley from the

12. *Human Geography*—Jean Brunhes, p. 452.

west. Here came the Vedic Aryans to disturb the peace and prosperity of the people of Mohenjo Daro. The enterprising Persians sought this valley also for building up their empire. The Buddhists, Afghans, Mongols and Turks took their turns, as time went on.

The adventurous Greeks closely followed the Persians, who had navigated the Indus for them for the first time. The virile Arabs came next along the Makran Coast and made good use of the river and the sea board. Sorely disappointed with the trying conditions in the desert, even the Rajputs sought a shelter here. From the neighbouring soft lands of Cutch, Kathiawar, Gujrat entered the soft people, the descendants of the races who had inhabited these parts in former ages and who were used to peaceful pursuits. Later still the enterprising Europeans, Parsees, and Christians have come to trade. Altogether some sixteen classes of people have settled in Sind.

The Result—a Clearing House of Cultures.

Thus Sind became a veritable cauldron of human passions. Raids, piracy and plunder were common. One race tried to crush another and another to suppress and to destroy a third. But nature's immutable law of indestructibility must prevail everywhere and from this great conflict of ideas, ideals, wants and differences, there has sprung in Sind a culture which can be called unique.¹³ Its very language Sindhi is a hybrid one—Sanskrit in origin and Arabic in style. It has produced a single class of cultivators called *Haris*, both Hindu and Muslim, to whom the question of crops or water supply is quite common in the region. Their music, daily life, even dresses and manners, are similar. But the best product of Sind is its Sufism, quite unique in the realm of philosophy. There are Hindu—Muslim saints who command the respect of both the communities in the province,—a sound beginning of Hindu—Muslim unity in India. Here there are few castes and fewer creeds and comparatively few folk belonging to the depressed Harijan classes. Even for Sikhism, Sind has served as a congenial home. The Sukkur Barrage has solved the problem of perennial canals once for all. Through the arteries and veins of its canals and distributaries, this heart of Sind is now pumping its water of life for all the inhabitants regularly and rhythmically.

13. *Vide my Settlements in the Lower Indus Basin, Part II, pp. 37-38.*

day and night. Thus Sind is rejuvenated by progressive man and the obstacles and difficulties of nature are vanishing. Now permanent settlements can also be made in Sind. The best gifts, which the British rulers have at long last given to the province, are agricultural prosperity and political autonomy.

It depends upon the natives themselves to keep eternal peace and evolve themselves further. It is a peculiarity of the population of Sind that there are no cities. It is mostly rural population of moving villages, which in suitable irrigated centres alone turn into agglomeration of villages. For this reason there were established several capital towns in the past dynasties as it suited them. The British have, on account of their seafaring character, founded the cosmopolitan city of Karachi, which being a good harbour, has now grown into the 4th city of India, while Hyderabad, the erstwhile capital of Sind, has a population of only about a lakh, mostly of the advanced and well-to-do class of Amils. The healing product for all the people, however, is their mystic poetry of Shah Latif, Sachal and Sami, leading to a kind of spiritual unity among them.

What Sindhis lack to-day is education, though they have always an All-India outlook on life and though as traders they have gone abroad freely. The political boundaries, further beyond it, must be discarded and more natural and elastic boundaries must be created to bring into operation still more forces. In an enclosed pool anything can become stagnant and ultimately decay. There must be a constant stream of civilisation passing in and out of the province for the welfare of the whole of our country. To-day Sind is not totally devoid of shortcomings. A land, such as this, constantly tries the patience of man. Its evil practices of cattle lifting, abduction of women, dacoits and murders, ill-treatment of the poor Haris by rich and unscrupulous Zamindars, and the latest phase of unstable ministries in an unstable land,—these are occasional flashes of man's self-expression. In a region, in which the forces of nature are so dynamic, such outbursts are bound to take place. They can be got rid of by a carefully planned system of education based on its geographical environment and an introduction of fresh blood from new settlers, as the whole trouble in India is maladjustment of population and not overpopulation. It is also noteworthy that there is in Sind a great scarcity of women in the first place. At the same time, to make the Barrage a greater success than it has proved itself to be, there must be better and more

judicious distribution of the waters among cultivators and a better sense of administration from a more powerful central government.

Concluding Remarks

The cultural boundaries of Sind have been pushed back by civilised man. Clannishness, from which other Indian provinces suffer so much to-day, has been avoided. A Sindhi claims himself to be an Indian, as he has given this very name to the whole country, and carries his culture to distant parts of Asia through commerce and trade. In many respects the interests of the Punjab and Sind are common as falling within the same valley. Thus human actions and natural phenomena have not been separated in this region. One has reacted well on the other. There is really an endless interaction of conditions, physical and human, in the entire Indo-Gangetic plain. Occasionally the political factor has intervened. With the sudden rise of a hero on the Iran plateau or the neighbouring lands, the Indus valley,—both the Punjab and Sind,—was invaded and plundered. But apart from such political gambles, the natural environment has produced its healthier effects. It has, on the whole, made the Sindhi strong, peace-loving, philosophic, forbearing. He builds no great mosques or temples, no palaces, no mausoleums or permanent settlements within this ever-changing and unstable region. Like the great river, the Sindhi farmer has learnt to receive and to give gifts. Sind's cultivatable soil is itself foreign, in as-much-as it is drifted by the Indus system from the gigantic mountains and dropped into the valley by the floods for the poor Haris to reap their crops from. As long as the river inundations were irregular and unstable, the farmers remained fatalists, believing in Kismet, but now with the assurance of a stable water supply from the world's most stupendous irrigation system they have adjusted their farms and their homes. There is now a regular rotation of crops, Ragi and Kharif, as the freshly drawn ergograph shows. No longer are the people lazy or jobless during the year; circumstances and natural environment make them so. Rather there is a great scope in the Barrage area for immigration and more settlements, the density of the population being only 84.

Such an impartial and scientific study, (not dry bones of history), of the regions forming our Indian provinces will reveal many valuable correlations and phases of our varied Indian cultures, and the people will cease hating one another because of the political,

provincial or colour barriers. Such useful work awaits to be done by University Departments of Geography in the faculties of Arts as well as Science. It cannot be delayed if we want to live in peace and to have a good government of our country by our own people; it cannot be denied to our Indian youth, as upon it rests their proper education and upon such research, done on a *co-operative basis*, also depend the safety and peace of the whole civilised world. Will our Indian Universities introduce this study and encourage researches into the Science of Geography to help in this great consummation?

Geography in Post-War Education

By

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It is easy to wage wars, destroy buildings, demoralise people and kill civilization and culture. It means simply a pull at the trigger. But to reconstruct when firing has stopped and fires have been extinguished is certainly not so simple a matter. It requires time, patience, mutual help and resources.

To rebuild buildings and railways and post offices is easy but to revive civilization, love and sympathy is a much more tremendous task. It requires different materials and labour. Its chief architect is education, liberal education, that is not mere collecting of information but which makes a man a 'man' that pours understanding and love and sympathy into our hearts; education that is preparation for a life of peace and progress and mutual good-will. Such a liberal education is all embracing and international, and free from prejudice, and in it we are, out of necessity, called upon to form a clear vision of our world. A thorough study of the world should form an integral part of liberal education; because it is essential for those who are occupying the world's chancelleries, and this study should be out of necessity, therefore, given stress in school and college curriculums because the students of today shall occupy the chancelleries of tomorrow.

When the present war is over and peace and democracy reign again, concerted efforts will have to be made for establishing dominion of love and peace and mutual good-will on a firmer basis. As such liberal education with its various branches will have to be brought within the easy reach of all.

Geography, because of its subject-matter, must take an important place in such an educational scheme. It is the only subject that is most potentially capable of achieving our ends. If there is no determined effort to impart sound geographical knowledge involving national and international issues, education may produce harmful effects, by fostering again a spirit of stark jealousy and ill-will that resulted in the present war.

The Geography teacher, therefore, shall need a special philosophy as well as a technique, if he is to serve his generation in a most effective manner. Besides being a master of the art of teaching, he must also appreciate to the full the useful subject-matter within his reach in its varied manifestations. It is this understanding that will largely determine his attitude to his work and guide him in drawing up his syllabus and preparing his lessons.

What are, therefore, the fundamentals of such 'future geography'? Geography will have to advance fast from the 'factual' stage to the 'rational' stage. Each geographical fact will have to be explained in relation to the cause of which it is the effect. Data will have to be presented not as isolated abstractions but as inter-dependent features the result of cause and effect. A natural region with its typical soil formation, its peculiar climate, its rivers, its natural vegetation and perhaps its artificial irrigation and their effect on human life there-in should serve with increased stress as the chief instrument of geographical study.

In future geography, the geographical influences operating on the life of the people of a particular area will have to be made the centre of our interest. It is the study of the adjustment of human groups to their geographical environments.

Under such an impulse, therefore, geography teaching can no longer be regarded merely as a means for vocational purposes or merely as an item in the "High School Examination" syllabus. Its aims are higher, it attaches great importance to human elements. It forms an indispensable part of education, in the truest sense of the term. Such an education will bridge many gulfs, remove any prejudices, and bind the different peoples of the world in ties of humanity and universal brotherhood.

What is the upshot of this discussion? The answer lies in the teaching of geography with a feeling of 'Humanity' so as to create human sympathy, good-will and co-operation. In a world mad with the active and deadly ideas of competition and territorial supremacy, the necessity of creating at least an understanding if not actually a liking for other people imposes itself upon society. Understanding depends solely on an unprejudiced appreciation of the cold facts of "existence" and the realisation of world-wide inter-dependence.

Mere factual knowledge will not in any way be instrumental in creating the desired international good-will. Geography can easily become "the talking of a jargon about coloured shapes on a map". The teacher must, therefore, create in the pupils the tend-

ency to pierce through maps into the heart of the country and the people living therein. To help them to look through maps the teacher may profitably make use of the film and the radio. The former, besides presenting facts, gives valuable experience that moulds information into 'knowledge' and 'life' itself.

Geography, therefore, will have to be increasingly taught with a social rather than an academic bias. To the dry solid facts of the text books must be added a humanistic touch revealing the actuality of the international inter-dependence and the need for closer co-operation—both economic and moral. The ideal may sound rather high, even perhaps fantastic to some, particularly in the world of to-day with its 'dominating races'; its deceit and broken promises, but the geography master (and along with him other masters too) working quietly, can, I am sure, reshape the whole atmosphere where no dictatorial forces would be able to destroy the ever-lasting public ideal of peace and good-will and economic harmony. It would be a world of co-operation rather than of devastating competition, of friendship rather than of bitter enmity, where a man will be a citizen not only of a particular state but of the whole world.

In the new era of peace and good-will that will dawn upon the world, geography can no doubt play a prominent part in broadening the outlook of men. In schools and colleges geography will have to be made a 'pivotal' subject. An increased interest in geography will have to be created in all men and women so that they may rightly understand world problems and international relationships in their true perspective. Geography will create an understanding of, and a sympathetic interest in the lives of other people and appreciation of the kinships and inter-dependence of the world.

In this way economic strifes, political disputes, communal misunderstandings, racial antagonisms and other sources of bitter hostility will disappear from the face of the earth, and the different races and peoples will live in perfect peace and amity. 'Utopias' and 'millenniums' will cease to be mere dreams and phantasies when people will come to realise fully the strong geographical bonds which bind all nations in close ties of fellow-feeling and brotherhood.

Geography, therefore, can and should be made to play a very noble and useful role in post-war reconstruction, if at all we are anxious to possess an uninterrupted and life-long peace and prosperity. Then also we shall have something useful and bright to give to our posterity.

The Physical Aspects and the Geology of the Chittoor District

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The District of Chittoor lies between longitudes $78^{\circ}4'$ and $79^{\circ}13'$ E. and latitudes $12^{\circ}46'$ and 14° and is roughly rectangular in shape. It is bounded by Anantapur in the north-west, Cuddapah in the north, Nellore in the north-east, Chingleput in the east, North Arcot in the South and Mysore state in the west. It lies to the eastward of the plateau of Mysore where it descends down in terraces to the coastal plain of the Carnatic. The general slope of the eastern half of the district is towards the south and east, thus falling within the drainage basin of the Palar; the western or more particularly the N. W. half slopes towards the north draining into the Penneru. Besides these two drainage systems, a part of the district drains into the Bay of Bengal through the Swarnamukhi and a few other small streams.

The greater part of the district has an elevation of over 500', only about $\frac{1}{6}$ of the district along the South-Eastern margins being below that level. The average elevation of the whole area is about 1500'. The district, though small has a varied scenery; gentle rolling uplands, inselbergs and rugged scarps scattered widely, relieve the monotony of the plains and plateau alike, for though the latter is at a certain elevation above sea level, it yet retains a general plain-like feature. It may be termed an elevated plain with a gentle undulatory surface with conical and rounded hills cropping out like islands in a sea. It is very different from the coastal plains and is more broken by stream valleys, more undulating and is everywhere dotted over with occasional long ridges having wall-like and serrated crests standing out with peculiar conspicuousness.

Orography

The district as a whole has a high average elevation and plain and plateau alike are dotted with a number of hills some of which

rise to heights of over 3000'. The mountains of the district may be grouped under 3 heads :—

- (a) Those forming the eastern scarp of the plateau;
- (b) The mountain mass of Tirupati;
- (c) Spurs from the Eastern Ghats.

The mountains forming the Eastern Ghats which extend across the district in a roughly S.W. to N.E. direction are not mountains in the strict sense of the term. They form the eastern edge of the plateau of Mysore which has been moulded and shaped repeatedly by the sub-aerial agents of erosion. Consequently, they have this appearance of a mountainous mass to an observer on the plains but not so typically to one on the plateau. The Ghats do not form such a continuous and unbroken feature as do the Western Ghats along the western edge, but as the drainage of the plateau is mainly to the Bay of Bengal, they are much broken up by the several rivers breaking through on their course to the sea. These breaks in the Ghats have provided excellent channels of communication between the plateau and the plain. Within the confines of the district there are 4 important passes which have been taken advantage of for laying roads and railways and some of them have proved of strategic value in the military campaigns in the Carnatic.

1. *Kalluru Pass* named after the village of that name on the plateau. Two of the headstreams of the Poini rivers, the Chintalavanka and the Peddavanka enter the plains in the neighbourhood of Damalcheruvu and the trunk road to Cuddapah follows the former valley and the metre gauge line of the Madras and Southern Mahratta Railway follows the latter valley route. Both these routes lead into a part of the Mysore plateau where it is not very high, and the ascent into the plateau along these routes is not very steep.
2. *Mogili Ghat* lying due west of Chittoor is taken by the Chittoor-Bangalore Road.
3. *Sainigunta Ghat* lies further south and through this runs a road from Gudiyattam to Palmaner.

In the region of Mogili and Sainigunta Ghats the plateau has a much higher average elevation and the passes have a relatively stiff gradient. To protect the road surface against erosion in such steep gradients the

roads as in the case of Mogili Ghat have been laid in concrete.

4. *Nayakkaneri* Pass, due west of Gudiyattam, used to be the principal ascent from the plains to the plateau; the route lies along the valley of a tributary of the Malattar, but the gradient is so much steeper than the others that the route has largely been displaced by the Mogili Ghat Road and the more southerly one via Hosur.

Besides the above-mentioned well-developed passes there are a number of gaps in the scarp face of the plateau; but they are all so steep that they are little more than mountain pathways and no regular roads are laid along them. But a small amount of traffic passes through them on pack animals.

The line of hills formed by the eastern edge of the plateau finally merges with the Tirupati hills in the northern part of the district.

The Tirupati and the Velikonda hills are mountains in the strict sense of the term. The Nagari, Nagalapuram and the Kalahasti hills all belong to the same group. They have all been formed by the deposition and later uplift of true sediments. They are the southern-most representatives of the vast area of rocks which are exposed at present along a crescent shaped outcrop with its concave sides facing east. The eastern edge of the crescent is formed by the Velikonda ranges, the western-most edge by the Palakonda and other hill masses. Both the ranges gradually converge towards the south towards the holy mountain of Tirupati. The southern ends of the two ranges are separated by a fairly wide valley which passes northwards into the Cuddapah basin. The ascent from the plains is fairly gentle and the north-west line of the M. & S.M. Ry. passes along this break in the chain of mountains on its way to Bombay.

South of Tirupati in the direction of convergence of the Palakonda and Velikonda lie the Nagari-Nagalapuram hills and further south the Nagari nose mountain. The Tirupati Velikonda hills are separated from the Nagari by the broad valley of the Swarnamukhi river. The northern edge of the valley in this section is marked by a line of faulting (to be referred to later) which has brought the Cuddapah formation into juxtaposition with the gneiss. This well marked line of faulting along the northern edge of the valley and the occurrence of the representa-

tives of the Cuddapahs south of the valley in the Nagari hills taken together may mean that the broad valley of the Swarnamukhi had originated as a resulting of faulting.

Lying between Tirupati hills and the eastern edge of the plateau is a very confused mass of hills lying in Karvetnagar Zamindary area. These are made up partly of spurs from the plateau and partly of isolated masses of hills diversifying the plain country. A broad and fertile valley through which the railway line from Arkonam and Renigunta passes separates this group of hills gneissic in character from the Cuddapah formations of the Nagari-Nagalapuram group.

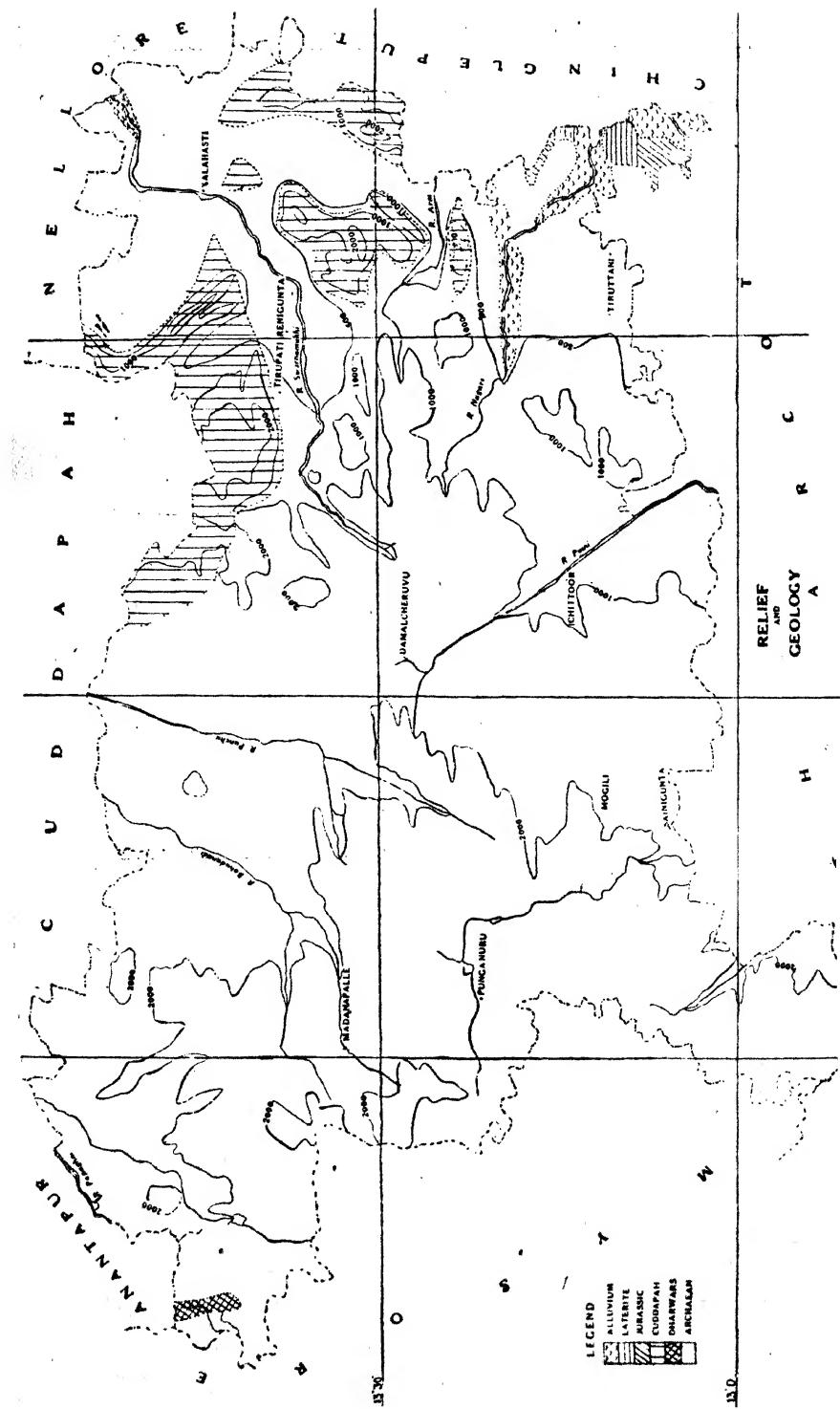
Drainage

The S.W. to N.E. trend of the Eastern Ghats very nearly divides the Penneru drainage from the drainage basin of Palar and Swarnamukhi. An E. to W. line across the plateau from the Avulapulle Drug on the Ghats through Punganuru to Rama-samudram more or less separates the northerly drainage from the south-flowing rivers. The bulk of the plateau region in the district is within the Penneru basin. East of the Ghats the area is shared by 3 drainage basins, the Palar, the Swarnamukhi and Nagari-Arni systems.

Penneru Drainage

3 rivers—the Papaghni, the Mandavi and Bahudanadi drain into the Penneru from the district. The Papaghni rises near the Nandi hills in Mysore and after passing through the State for some distance enters the district near Tsadam forming a feeder for the large tank of Kandukuru; emerging from the northern side of the tank it takes a northerly course leaving the district a little beyond Kandukuru.

Bahudanadi rises in the hills to the west of Madanapalle, flows eastwards past Madanapalle and after crossing the hills to the east of the town it turns north-eastwards, a direction which it maintains till it leaves the district. After its confluence with the Punchu it goes on as the Cheyair. In its course across the district the river flows as a perennial stream in a fairly broad valley; but at some distance before leaving the district it narrows considerably. On its right bank it receives an important tributary the Punchu or Punchunadi, which, rising in the hills east of Punganuru has a remarkably straight course trending in a direction 5° to 10° East of North. This roughly parallel direc-



tion of the several rivers—the Papaghni, the Bahudanadi and the Punchu cannot be purely accidental, but probably has a structural basis. This may in some measure be related to the intrusion of trap dykes, to be referred to later which are mostly in either of two well defined direction N. to S. (5° to 10° on either side of North) or N.E. to S.W.

Palar Drainage

The rivers, Malattar, Kaundinyanadi and Poini drain the district southwards into the Palar. Of these Malattar and Kaundinayanadi rise within the plateau and flowing southwards break through the Ghats in picturesque gorges to join the Palar near Ambur and Gudiyattam respectively. The Poini rising within the Ghats above Damalcheruvu has again a remarkably straight course in a direction about 30° east of south to join the Palar in North Arcot district.

Swarnamukhi

This river rising in the hills near Pakala, flows North-eastward in a narrow steep-sided valley and on rounding the hill fortress of Chandragiri is deflected by the Tirupati hills into a broad valley opening out into the east. Keeping nearer the south side of the broad valley, it strikes against the Kalahasti hills which turn it northwards and finally turns to the N.E. before leaving the district.

The Arani-Nagari System

The Arani and the Nagari are the only other rivers of importance in the district. The former rising in the hills west of Puttur flows round the southern edge of the Nagari hills and then in an easterly direction into Chingleput district. The Nagari rising in the hilly region to the west of Karvetnagar has an almost straight W. to E. course until a little beyond Nagari where it takes an acute turning to the S.S.E. to join the Tiruttani river the combined waters of which are emptied into the Kortallaiyar. The abrupt turning of the river a little beyond Nagari is rather peculiar. The more normal course of the river would be a continuation in the same direction (W. to E.) to meet the Arani river in the neighbourhood of Nagalapuram. There is reasonable evidence in support of this conjecture in that it is possible to trace a continuation of the valley eastwards through Attur to the Arani river. Secondly there does not seem to be any definite evidence as to why the river should have taken this sudden and

acute turning. Thirdly the course of the river below the turning point is through a cutting in the gneiss about $1\frac{1}{2}$ miles long which appears to be highly artistic. It is but reasonable therefore to suggest that the original course of the Nagari has been probably artificially diverted to its present channel (supported by tradition).

The rivers of the district are for the most part of the year dry and they get swollen when the monsoon rain brings in heavy freshes. These periods of flood are but of short duration as the river subsides as speedily as it gets swollen.

Geology

The main features of relief of the district are closely related to the geology of the area. If the district were to be denuded of the artificial deposits which so largely form the surface, it will be seen that rocks of two distinct formations make up the bulk of the area. The geological formations met with in the district are :—

5. Recent Alluvium
4. Older alluvium
3. Cuddappah
2. Dharwar
1. Archaean

Archaeans

The gneissic rocks of the Archaean system occupy the largest area and form the basement on which rest all the later formations. Roughly all the area lying West and South of the Tirupati and associated group of hills is gneissic in character. They underlie the superficial soil mantle of the lowland and the plateau and the alluvium of the river valleys and form almost all the hills of the plateau, the rugged scarp forming the eastern edge of the plateau and numerous spurs and the confused mass of hills lying eastward of the edge of the plateau. The North-Western line of the M. & S. M. Ry., between Arkonam and Renigunta forms a convenient geographic line for the gneiss east of which they dip down and disappear under later formations. Within the region thus enclosed the rocks give rise to a characteristic scenery—a rugged region broken by numerous great rounded hill masses (Chandragiri) with occasional steep faces, or by smaller hillocks and bosses with smooth curved slopes and rounded blocks and

odd shaped tors lying about the country as if some giant had made use of this as play-things and left them lying like that.

The gneisses show abundant signs of having been much disturbed and tilted since their formation. They strike S.S.E. to N.N.E. in the southern extremities, gradually changing to a N. to S. direction in the central parts but turn northwestwards in the northern parts of the district—a change in strike which is a characteristic feature of gneissic rocks eastward of the plateau, in the latitude of Madras.

The predominant variety of the gneisses consists of massive and generally coarse grained rocks referable to the granite or syenite clan (Bundelkhand gneiss). The fine grained and well-foliated schistose rocks so common in the southern districts are little developed in this area. This massive coarse grained and granitoid character of the rocks can be traced all along the Ghats in the various passes—the Satghur, the Sainigunta and Mogili Ghats—that lead from the plain into the plateau. Northward of the Mogili Ghat the same is developed in the Bodikonda and other hills stretching away to Avulapalle Drug. The same description applies also to the very hilly tract lying between the Poini and the N. W. line of the M. & S. M. Ry., while eastward of the railway they form the basement on which lie the later formed Cuddapahs in the Nagari hills and Jurassic rocks in the Satyavedu hills.

Locally interesting varieties of the gneiss are developed in various parts of the district. Along the western edge of the Nagari Nose mountain and exposed in the cuttings along the railway line are exposures of a handsome variety of porphyritic hornblende granite sometimes associated with epidote veins. The contrast between the pink dark green hornblendic matrix and the pink coloured crystals of orthoclase makes the rock a particularly fine specimen of porphyritic granite.

Another peculiar rock is a granite gneiss which includes masses of what appears to be an older gneiss, sometimes micaceous, sometimes hornblendic.

Associated with the gneisses are bands of magnetic iron ore which here and there crop out; they are probably representatives of the more numerous magnetic iron bands of Salem District.

Trap Dykes

The gneissic rocks of the district in common with those of the neighbouring regions are intruded into by crystalline rocks referable to 4 groups:—

1. Granite Veins,
2. Felspathic porphyries,
3. Quartz Veins, and
4. Trap dykes.

The trap dykes are by far the most important of the intrusions. They are extremely numerous, many of them are of large size and these form prominent features in the landscape in many parts of the country. The great majority of the dykes are coarse hornblendic traps and many of them are markedly porphyritic in character with phenocrysts of felspar in a hornblendic or hornblendo-felspathic matrix. The majority of the dykes can be classified under 2 systems according to the directions in which they trend (1) running in a N. to S. direction and (2) in a N.E. to S. W. direction. The former is less constant in direction trending 5° to 10° on either side of the N.; but both are made up of members which show little marked difference. Both the sets had been intruded before the formation of the Cuddapah System as they nowhere penetrate into members of that formation. The functions of the two sets are always obscure, but the clear relationship between similar set of dykes in the neighbouring district of Bellary and Raichur Doab seems to suggest that the infilling of the two sets of fissures was simultaneous. The traps were remarkable for their development in the N. W. part of the district—the Madanapalle area, and in the S. E. in the Nagari-Tiruttani area. The straight courses of some of the rivers—the Punchu and the Poini, may probably be related to the same structural peculiarities as gave rise to these igneous intrusions.

Cuddapah System

The Cuddapah System which is typically developed in the Cuddapah district is composed of much indurated and compacted shales, slates, quartzites and limestones with some times intercalated lava flows. The rock formations belonging to the Cuddapah system outcrop in the form of an irregular crescent with its concave side facing the sea. The westernmost edge of the crescent is formed by the line of hills that extends in a north-easterly direction from the Tirupati hills—the Palakondas and

the Errakonda hills up to and beyond Kurnul, the eastern edge being defined by a more well defined line of eminences—the Velikonda hills. It will therefore be apparent that the area under consideration comes to lie at the southernmost extremities of the type area where the two edges, the eastern and the western converge to form the tangled mass of mountains forming the Tirupati hills. But outliers of the Cuddapah formations are met with further south in the form of isolated patches capping gneissic formation in the Nagari, Nagalapuram and Kalahasti hills.

The western edge of the field for nearly all its length is a cliffy scarp of no great height at Kurnul end but gradually becoming higher and higher until in the Gulcheru and Tirupati hills there are vertical cliffs of as much as 700'. This feature of the formations can be well seen while travelling along the Boimbay line between Renigunta and Cuddapah and along the metre gauge line from Renigunta to Chandragiri. The Velikonda forming the eastern edge of the field arises abruptly from the Nellore plains often to an elevation of 2000' or more. Though its eastern face is very rugged and steep sided there is no well defined cliffy scarp looking out on the plains below as in the case with the western hills. The few scarps that are present, present their faces inwards to the basins—almost the reverse of Gulcheru and Tirupati ranges.

The Cuddapah system is divided into a lower and an upper division and each of these again is made up of two distinct sets of formations as follows :—

Upper	..	{	Kistna Series	Srisailam quartzites
			Nallamalai Series	Cumbum slates
Lower	..	{	Cheyair Series	Byrenconda quartzites
			Papaghni Series	Pullampet slates
		{		Nagari quartzites
				Naimpalli slates
				Gulcheru quartzites

Within the limits of the district only one of these series—the Cheyair series is developed. The members of the Cheyair series overlie unconformably the Papaghni series, the lowest member of the Cuddapah system. The members of the series may be traced straightaway from the southern extremity of the Cuddapah area at Tirupati all the way to Kurnul although they do not form a continuous ridge-like feature as do the underlying Papaghnis.

The lowest member of the Cheyair series consists mainly of quartzitic sandstones locally known as the *Pulivendla* quartzites (after the locality in Cuddapah district where they were first observed) or *Nagari* quartzites after the hill mass of that name in Chittoor district. The *Nagari* quartzite occurs as a capping of the summit peak of the *Nagari Nose*, the *Nagari* hills, the *Narayananavanam* hills and still further north the *Kalahasti* hills. Across the broad valley of the *Swarnamukhi* it can be traced in the *Tirupati* hills where they form bold escarpments facing west and forming a characteristic feature in the topography of the area; and thence northward right up to near Cuddapah as the western edge of the country under description.

Some of the ridges that fringe the *Velikonda* hills are capped by quartzites which may be representatives of the *Nagari* quartzite. They attain their maximum thickness at the southern extremities giving grand scarped cliffs in the *Narayananavanam* hills and in *Tirupati* where some of them are 800' to 900' in height. The maximum thickness of the formations here must be of the order of 1000' to 1500' but they gradually thin down northwards.

These cappings of *Nagari* quartzites where typically developed shows a three fold division as follows.

3. A series of massive and thick bedded quartzites (often very coarse sandstones and conglomerates) which are ripple marked and not so coarsely conglomeratic as the lower land.

2. Thinner bedded sands and flags 700' with occasional bands of talcose flags and occasionally somewhat slaty in character.

1. A series of thick and massive beds of quartzite sandstones and conglomerates which are more cleaved and jointed than the higher strata. 400' to 500'.

This triple banded structure is well developed in the *Kambakkam* and the *Ramagiri* hills, both outside the district. In the *Nagari Nose* mountain the peak is made up of the remnants of the lowest bed but the triple banded structure is discernible along the long eastern ridge of the mountain. The intermediate band of slates is very well defined along the southern flanks of the *Tirupati* hills and it separates the lower band of hard massive quartzites, forming fine precipitous cliffs from a second scarp of quartzites, developed well behind and above the lower one.

The most perfect sections of the *Nagari* quartzite is overlaid apparently conformably by a thick series of slaty shales with

layers of limestone and volcanic ejections and a peculiar set of well marked ferruginous chert and jasper beds known collectively as the Tadpatri shales. The thinner band of slates developed further south and known as the Pullampet slates are supposed to be identical with the Tadpatri shales of the north. The Pullampet shales consisting of a series of slates intercalated with limestones gradually thins down towards the south, but is continued as far as Balapalle in the northern boundary of the district. The rocks in this region are principally brown, grey or purple slates much cleaved and jointed and lying fairly conformably on the bottom quartzites.

The edge of the field of Cuddapah formations along the west and the south-west is a natural boundary—the scarp of the formations; and this continues up to Kirkambadi where the Nagaris and the gneiss are brought into juxtaposition. Still further east the slates which overlie the quartzites are also brought into juxtaposition with the gneiss; and finally in the southernmost extremity of the Velikonda the much disturbed bottom quartzites and slates are also brought up to the surface to lie in contact with the gneiss. There is thus a more or less E. to W. line of fault along the southern boundary of the area which abruptly terminates the formation and by which the Cuddapahs have been thrown down to the north to the extent of nearly 1000' at the eastern end of the line.

Jurassic formation

Upper Gondwana (Jurassic) rocks consisting chiefly of great beds of hard conglomerates and sandstones outcrop in the group of hills lying south-eastward of the Nagari mountains. Of these the Allikur hills alone come within the district; the geology of the Allikur hills and the mode of origin of the caves contained therein have been discussed in great detail by Mr. P. G. Dowie in an article on the Physical features of the neighbourhood of Madras.

Alluvial formations

The valleys of the principal rivers are all made up of fluvial alluvia and consist mostly of a coarse gritty sand. The broad valleys of the Kortallaiyar, the Nagari and Swarnamukhi are all made up of this fluviable alluvium—the older alluvium. The rivers seem to have been rejuvenated to a certain extent so that they are cutting into the older alluvium.

Economic Products

Excepting building stones the district cannot boast of any large number of economic products. The granitoid gneisses of the district represent an inexhaustible supply of good quality building and ornamental stone. It is extensively being quarried in the Tiruttani area and in the Sholingur area.

The quartzites of the Cuddapah formation are too hard to be worked into structural material cheaply and is therefore used only as a rough building stone.

The Forests and Forest Products of Chittoor Division

By

ROWLAND MITCHELL,
District Forest Officer, Chittoor

I. Introduction

The greater extent of the forests of the Chittoor District come under the class termed "dry fuel forests" and these dry fuel forests of the Madras Presidency are one of the important types, if not the most important type. They occur in some 22 of our 28 forest districts and certainly have their effect on a larger proportion of the population than any other type. This forest type has many sub-types and its species and general conditions vary greatly as one goes from North to South or even from East to West of the Province. but its general conditions and general problems are much the same throughout.

The dry fuel forests are essentially "local" forests and supply the needs of the local villagers with fuel, agricultural implements, small building timber, grazing, etc. Therefore these forests are of vital importance and this has become more so since the dry fuel forests of the unreserves, waste lands and Panchayat forests have either completely disappeared or are very rapidly disappearing due to the ravages of man and his animals—chiefly goats.

Hence the improvement and maintenance of these forests are an absolute necessity, for on them depends the welfare of the agricultural population.

II. The Forest—Composition and condition of the crop.

General Description.—The forests vary from dry mixed deciduous to thorny scrub, with occasional patches of dry ever-green growth. Two distinct soil types are to be distinguished, one which occurs over the Cheyyar and Nagari sub-divisions of Cuddapah geological formation and the other over the Archaean gneissic formation. The former, which is wholly confined to the Seshachalam Range of hills, is unique in that it contains a natural growth of red sanders.

III. *Distribution of Forest Types*

(a) *Red sanders forests*.—These may be divided into three altitude zones—viz., (1) Terai forests upto an elevation of about 800 feet; (2) Hill forests upto about 2000 feet; and (3) Terminalia—Eugenia—Shorea forests above 2000 feet.

(b) *Dry evergreen type at Mamandur*.—In the Mamandur valley, which is about 600 feet above Mean Sea level, a dry evergreen type of vegetation is to be met with.

(c) *Shorea type near Talakona*.—Near the Talakona temple—elevation 2000 feet—along the banks of the Talakona pilla stream, a unique patch of about 200 acres of forest occurs, with Shorea talura and Mango trees preponderating. Some of the trees in the better soil areas are 60 to 70 feet in height.

(d) *Forests of the Bhakarapet Plateau*.—In the plateau portions of the Bhakarapet Range falling in the Vayalpad taluk, the growth though good is chiefly miscellaneous. In this part of the district, rising above the plateau level are small outliers of the Seshachalam range of hills. On these, which belong to the Cheyyar sub-series of the Cuddapah geological formation, red sanders is to be found growing almost gregariously.

(e) *Forests in the rest of the District*.—Over the rest of the district the forests occur over the gneissic formation. The growth is largely miscellaneous, except in the small reserve of Chittoor, where successful artificial regeneration, chiefly of red sanders, in the past has changed the original composition of the crop.

(f) *Palmaner plateau forests*.—The forests of the Palmaner plateau (generally above 2000 feet elevation) contain sandal in addition. Dry evergreen patches of growth are also to be met with and in them large numbers of Sandal trees are to be found. The Sandal are invariably stunted and stagnant and it is evident that the trees in these evergreen type of forests provide very poor hosts to the sandal. In addition there are several artificially raised topes in the Palmaner Range.

IV. *Bamboos*

Both *Bambusa arundinacea* and *Dendrocalamus strictus* occur and occupy about 12,000 acres. In the Palmaner Plateau, however, bamboos are sparsely distributed. During 1939 and 1940 both species of bamboos have flowered and died gregariously; this

is a serious loss, as bamboos are a very valuable product and yield a handsome annual revenue. It is reassuring, however, that natural regeneration is satisfactory, but it will take 8 to 10 years before the seedlings produce mature culms fit for exploitation. The bamboo *Dendrocalamus strictus* is being regenerated artificially on a large scale in suitable localities, where it does not occur at present. The method of regeneration is to put out one to two year old rhizomes in prepared pits.

V. *Sandal*

The chief Sandal areas are in the Palmaner plateau. There has been no case of spike disease so far, which is a great blessing; but the sandal over the greater part of the area are stunted and yield very little heartwood. In the rest of the forests and in all topees sandal was introduced artificially in the past in suitable localities and is spreading naturally.

VI. *Weeds*

Under this head strobilanthes and grass deserve special mention. The former forms a dense undergrowth in the Mamandur Valley, especially in areas which contain a thick growth of dry evergreen scrub. In such places it is so thick that the seedlings and coppice shoots of tree species are suppressed by it; it also prevents the seeds of plants reaching the ground. Like lantana, it is a pest and when it flowers and dies increases the fire hazard.

Grass comes up in large quantities on account of the open nature of the forest crop in many places. Besides smothering the young seedlings, it enhances the fire risk, especially Bodha (*Cymbopogon coloratus*) grass, which is highly inflammable owing to the essential oil it contains.

VII. *Climbers*

There are numerous climbers, but the most troublesome ones from a forest point are *Pterolobium indicum*, *Acacia pennata*, *Acacia instia*, *Mimosa rubicaulis* and *Zizyphus aenoplia*.

VIII. *Parasites*

Of the parasites *Loranthus* and *Cuscuta reflexa* are the most common ones. A certain number of Epiphytic *fici* are to be met with.

IX. Condition of Forests

The present condition of the forests is far from satisfactory and they have deteriorated to the state we now find them chiefly due to the numerous and extensive fires—90% of which are caused wilfully by cattle graziers to get early grass—and to the ravages of man and his animals.

In 1652, the French traveller and jewel merchant, Jean Baptiste Tavernier, passed through the forests near Tirupati and wrote as follows:—

“The place is very pleasant and derives its coolness from the numerous streams and fountains.” He has also mentioned that elephants existed in these forests and were being captured by the pit method. Any one going through these forests at the present day can hardly give credence to the above facts chronicled some 300 years ago!

X. Chief Forest Products

(a) *Timber* of *Shorea talura* and *tumbaggaia* and posts of Red sanders.

(b) *Fuel*.—Most of the fuel is consumed locally, but the fuel from the Mamandur Valley is exported to Madras by rail.

(c) *Bamboos*.—The bamboos extracted in the division are mostly consumed locally. The bamboo extracted from the Chamala and Mamandur Valleys and the Mungilpet reserves are exported to Tirupati, Nellore and Madras.

(d) *Minor Forest Produce*.—The following are the more important items of Minor Forest produce collected:—Seekai; Custard apples; fibre from *Agave* species; *Ippa* seeds; *Sarapappu*; tanning barks; Soap-nuts; *Tooki* leaves; honey and wax; and sandstone. The chief tanning barks are of *Cassia auriculata* and *Cassia fistula*. “*Tooki*” (*Diospyros melanoxylon*) leaves are exported to the important “*Beedi*” manufacturing centres like Madras, Vellore, etc. Soap-nuts are also an important item of minor Forest produce, which after meeting the local demand usually finds its way to Madras. Sandstone is quarried in the Tirupati Extension R.F. and is dressed into circular slabs and sold in large numbers to the pilgrims visiting the Tirumalai temple who use them for grinding sandal into paste. The quality of the sandstone obtained in this reserve is reckoned to be very good.

(e) *Sandalwood* is extracted departmentally and annually about 20 tons of final cleaned wood are extracted from the Palmer plateau forests and sent to the sale depot at Tirupattur. At present both green and dead trees are being extracted.

XI. Conclusion

Though the forests of the Madanapalle Taluk fall in the Chittoor revenue district I have not touched on them, as I am not acquainted with them since they are managed by the District Forest Officer, Anantapur.

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Cattle Wealth of Chittoor District

By

C. ANNAMALAI,

Agricultural Demonstrator, Madanapalle.

Introduction

The term "Cattle" includes bulls, bullocks and cows—these being useful to the cultivator in aiding or supplementing his income. In no part of the world are cattle of more importance than they are in India. In the Western countries cattle are kept for their milk and meat. But for us milk, though important, is a secondary consideration and the primary function of the cattle is as draught animals for the plough and cart.

In a country in which 90% of the population subsist on agriculture cattle play an important part. Cattle manure is used as fuel or serves to enrich the soil exhausted by cultivation. The operations of ploughing, harrowing, sowing and thinning, of lifting water from wells for irrigation purposes are carried on almost by bullock power. The crop when cut is removed to the threshing floor and there trodden out by cattle and transported to the market by them; in fact it would be difficult for the Indian cultivator to get on without his cattle, which constitute the life and soul of agriculture. The status of the ryot is usually estimated by the number of heads of cattle he owns.

Cattle Census

The number of cattle owned by a farmer is normally determined by the number required to work on the land. For every pair of animals about 4 acres of land could be cultured but in our district where the area cultivated is 7.9 lakhs of acres we are maintaining 12.5 lakhs of cattle. The number is abnormally high and is determined by the possibilities available for grazing them and also the manurial requirements of the ryot. This indicates, therefore, that in our district there are possibilities of reducing the number of cattle without necessarily reducing the standard of cultivation. This also suggests that the excess in number is due to inefficient animals.

Breeds

Chittoor is remembered in other parts of the Province as the birthplace of PUNGANUR cows, which are now almost extinct and which were known for their diminutive size and high milk yield. It is said that these cows were not bigger than an average goat and yielded easily 8 to 12 pounds of milk per day i.e., 2 to 3 Madras measures. There are even to-day some cows in some remote villages of Punganur which have traces of their ancestors. The members of the Royal Family at Punganur who were reputed for their unbounded interest in live-stock slackened their interest and allowed this excellent breed to die a premature death. Some years back after making a thorough survey of the whole tract Government offered to improve the breed by purchasing the available cows with traces of Punganur blood and making a pure-line-selection. But unfortunately the few ryots that had the cows did not agree to sell them and there it ended with the breed deteriorating with each generation.

Among the four districts in the Presidency that are known for their rearing of particular breeds of cattle Chittoor is mentioned as a rearing centre for Mysore breed—while the rest are Coimbatore for Kangayam, Salem for Alambadi and Nellore for Ongole breeds. Being a cattle-raising district the animal wealth of the place is enormous, particularly in the up-land taluks of Palmaner, Punganur and Madanapalle with their mild and salubrious climate, with their extensive pasture and grazing lands on which cultivation has not made much inroad, with their vast forest areas rich with hill-grasses, with their soils rich in lime which is so much necessary for the proper development and growth of animals and with their even distribution of rainfall, though scanty.

The physical features and environmental factors favour the proper *rearing* of Mysore breed of cattle in our district. But *breeding* with this pure type does not exist as a special trade in any part of the district. The ryot has not realised the importance of this national industry and so, breeding is not carried on in a systematic manner. But in a few villages of Palmaner and Punganur which border the Mysore plateau a few cattle of the ordinary type i.e., crosses between the local non-descript and the Mysore are bred. These are sold out in the local shandies and cattle-fairs to purchasers who come from the lower Taluks of this District and from North-Arcot and Chingleput Districts.

Cattle Rearing

Breeding of pure types is not done in the District but only *rearing* of these. Dealers in cattle from Palmaner and Punganur taluks visit the important cattle fairs of the Mysore State and purchase young stock of Mysore animals and after rearing them for a few months take them out for sale at important fairs and festivals in the Scuthern Districts of the Province. Some of these animals have been sold in Madura and Ramnad Districts.

During this "rearing" period the young animals are taken care of—perhaps more carefully than the children—and almost stall fed. They are usually purchased in the months of November and December when there will be plenty of pasture and fodder jonna in the dry lands. In the early hours of the morning these animals are hand-fed—one man per pair—and allowed complete rest. Towards evening these are grazed on field bunds and harvested dry-lands more for giving them exercise than for feeding them. Seldom are they worked during those periods. Such rearing for 3 or 4 months will marvellously improve the growth and condition of the animals and from March onwards these animals will be taken to cattle fairs for sale. In most of the cases for each pair of animals from Rs. 40 to 60 will be earned by the rearers. Thus much about the pure Mysore cattle.

For milking purposes Mysore cattle are not reputed. Milch cattle of Ongole type or crosses between this and the local non-descript breeds are found in Kalahasti and Tirupati and in small numbers in Chittoor town. Gollars from these places go to Nellore and its neighbourhood and purchase cows with calves or cows in calves. Occasionally we see dealers in these animals coming with large stocks of these cows and also older heifer calves for sale. They start from Kalahasti and proceed to Tirupati then to Chittoor; and the unsold animals, if any, will be taken to Ranipet etc. They do not get up the Ghaut portion of our District as there is no demand for these huge animals in these Taluks. So it is, we find, in the upland taluks.of our District, only Mysore-cross cows.

A few years back a Dairy farm was started by the Rajah of Kuppam and he imported some Sindhe cows from Karachi. For reasons best known to himself the Rajah after a few years dismantled his dairy and so, we see that in some of the villages of Kuppam there are Sindhe animals and their crosses. In the Rishi Valley farm of Madanapalle taluk there is a dairy herd of cattle—

some Sindhe, some crosses of Sindhe and Ayrshire etc., but these animals are confined to the Estate lands. A few calves considered as excess on this Valley farm have been sold out but they are only a few.

Then comes the rearing of the mongrel or the non-descript local breeds. The number maintained by each ryot depends on his manorial requirements, generally one animal for each acre cultivated. Bullocks of these breeds are generally docile and easily trained. They are not fast trotters but are suitable for heavy draught, and at road work. These are bred in all the upland Taluks of the District. But there are no families or places specially reputed for such breeding.

Rearing of these animals is by Forest grazing or Communal grazing. Communal grazing consists of grazing on land to which every one in the village has an actual or accepted right. This is comprised of communal lands set apart for the purpose, of unassigned waste lands, of tank beds, sides of roads and porombokes. Forest grazing is the rearing of these animals in the Reserved or Unreserved Forest at a nominal fee per head. This is also another form of communal grazing. Grazing and Forestry are, and must be at variance; for, as the forest canopy increases, the grass tends to disappear. Lately, several blocks of Forest reserves have been handed over to Village Panchayats as grazing grounds for their cattle and these are completely controlled by the Panchayats. This system appears to be much more popular and it is hoped that these bodies will pay strict attention to the number of cattle grazing in these reserves and not allow them to be over-stocked and that they will do all they can to improve the quality of the grazing.

As far as the maintenance of the quality of the stock is concerned, nothing can be said in favour of communal grazing and in fact everything is against it. Normally the common lands are over-stocked, are never given any rest and are only exercise grounds for cattle. In many cases the number of cattle maintained is in excess of the ryot's requirements as well as the number that he can normally supply with fodder in the dry season. Though the animals manage to exist for a time on the starvation diet, they are in such cases prone to cattle diseases.

Communal or mixed grazing leads to the evil of in-breeding and promiscuous breeding and often permanent injury is done to the young male stock from serving cows when too young. In such

grazing, mating takes place between any animals and the smaller bulls, being usually more active, are responsible for more breeding than the larger ones. And the first and important principle on breeding, namely best to mate with the best is lost.

From time immemorial there existed only mixed grazing but the condition of the animals was maintained because of the existence of BRAHMANI BULLS. These were carefully selected bulls and dedicated to some temples. They helped to maintain the standard of animals and prevent degeneration. They will be the common property of the villagers and allowed every licence, even to the extent of grazing on private fields. They follow the herd during the day and being accustomed to graze on rich crops, seldom pay attention to the poor grazing on the common land. They run to the field crops and take a fill after the rest of the herd return home. In some cases they were not selected from the same herd to prevent in-and-in-breeding. At the present time the selection of the bull has become a formality, the ryots drive off the bull from their farm lands. This also has become a forgotten custom and there are very few Brahmani bulls in the District, and even if they are, they are very poor specimens of animals. This is one of the useful customs that has become extinct, and its revival will greatly benefit the breeder.

Conclusion

I suggest the following points for improving the cattle of our District.

Ryots must be induced to have as few cattle as are necessary for tilling their lands. For their manurial requirements they must depend on compost, green manures etc.

In forest grazing only cows and castrated animals must be allowed.

Grazing porombokes should not be assigned to ryots for cultivation.

In both the above grazing places blocks must be marked out so that in each block animals graze by turns. This will allow time for grass to grow in blocks in rotation.

The system of introducing BRAHMANI BULLS must be revived. Or else advantage must be taken of the encouragement given by

the Government for maintaining breeding bulls. By this system each ryot that maintains an approved bull will get a premium of Rs. 100 per year for three years under certain rules that are enforced by the Veterinary Department. Any organised body like the District or the Panchayat Board or Municipality, or even an individual will be eligible for this concession. The amount paid by the Government will not only cover the expenditure but also will leave a margin of profit to the ryot.

All small animals and those that are unfit for breeding purposes must be castrated early so that they do not get chance to deteriorate the breed.

All animals must be inoculated in time against all contagious diseases.

Population of Chittoor District

By

M. P. RAJAGOPAL, B.A., L.T., DIP. GEOG.

¹The District of Chittoor was constituted with effect from 1st April 1911. It comprises the taluks of Chittoor, Palmaner and Chandragiri transferred from the old North Arcot District; and Vayalpad and Madanapalle transferred from the old Cuddapah district, as well as the zamindaris of Punganur, Kalahasti and Karvetnagar. Kangundi (Kuppam) taluk of North Arcot District with the exception of 22 villages was transferred to the Chittoor District on 1st December 1928, and added to the Palmaner taluk of Chittoor division. The district is bounded on the north by the Anantapur, Cuddapah and Nellore districts; on the east by Nellore and Chingleput districts; on the south by the North Arcot District and on the west by the Mysore State. It covers an extent of 5,904 sq. miles, and comprises the following revenue divisions:—

(1) The Chittoor Division consisting of Chittoor and Palmaner (including Kuppam) taluks; (2) The Madanapalle Division consisting of Madanapalle and Vayalpad taluks and the Punganur Zamindari; (3) The Chandragiri Division consisting of Chandragiri taluk, Puttur and Tiruttani taluks and the Kalahasti and Karvetnagar Zamindaris.

Population

According to the census of 1941,² the District has a total population of 1,632,000. Chittoor District comes 15th in the order of the population among the 25 districts (Madras excepted) of Madras Presidency, (its rank in 1931 being 17th in the Presidency), and its population is slightly below Presidency average (1,973,640).

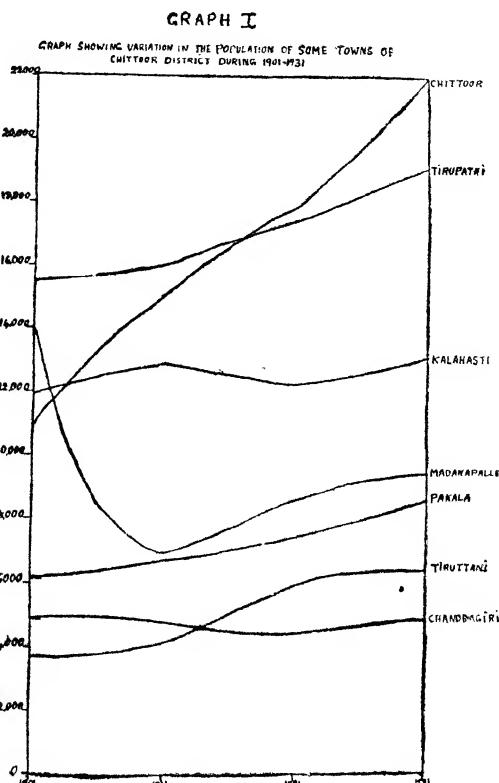
In the District there are only eleven towns of over 5,000 inhabitants in each, and two towns of over 10,000. Chittoor with a population of 22,018 is the headquarters of the district. The

1. G.O. No. 1118, dated 4th Dec. 1911.

2. Census figures published in *The Hindu*, dated 16th Mar. 1941.

other important towns in the district are Tirupathi (19,138), a place of pilgrimage well-known throughout India, Kalahasti (13,152) also a place of pilgrimage, Madanapalle (19,459) a health resort with a Tuberculosis sanitorium, and Punganur (8,278)—where car festival and cattle fair are held in May of every year. Tirupathi and Chittoor are the only two Municipalities in the district. Pakala (8,662) and Renigunta are important railway junctions. The urban elements per 1,000 is notably low in Chittoor district, being only 57, and the district approximates more to Deccan than to Tamilnad conditions. The western part is markedly below the eastern in urban contribution.

The graph shows the growth of some towns in the District from 1901 to 1931. Only the two Municipalities seem to have grown up while the other important towns have increased very little. But Madanapalle shows a sudden fall in population from 1901 to 1911. Pakala has risen steadily by virtue of its position as a railway junction.

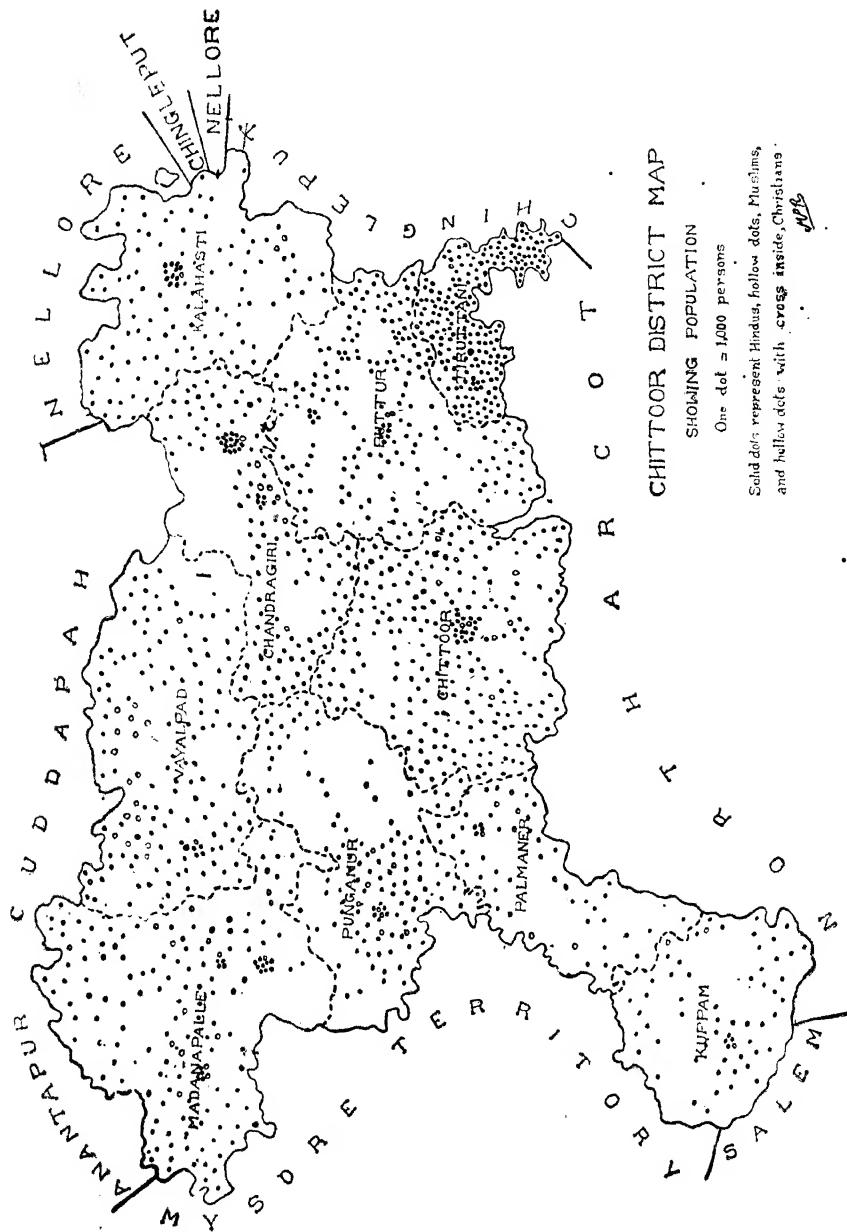


Density of Population

The district stands 19th among the 25 districts in the Presidency (Madras excepted) in regard to the density of its population, with an average of 245 persons to the sq. mile. This density is much below the Presidency average—329. According to the census of 1941 the density is 276 persons to the sq. mile and the increase during the last decade is slow. The distribution of population in the district is as shown below:—

Taluk	Area in sq. miles	No. of Towns	No. of Villages	Total Pop. (1931)	Density of pop. (1931)
<i>Chandragiri Div.</i>					
Chandragiri	..	548	1	222	132,459
Kalahasti	..	622	1	341	118,031
Puttur		542	—	347	196,111
Tiruttani	..	401	1	329	198,455
<i>Chittoor Div.</i>					
Chittoor	..	786	1	344	258,100
Palmaner	..	411	—	87	59,567
Kuppam (Kangundi)	..	305	1	250	61,367
<i>Madanapalle Div.</i>					
Madanapalle	..	836	1	104	153,618
Punganur	..	648	1	105	122,271
Vayalpad	..	802	—	125	147,124
District Total	..	5,901	7	2,254	1,447,103
					(District Average)

The southern Taluks of Chittoor district are more densely populated than the north and the Taluks on the Mysore Plateau. Palmaner is the least populous of all with 145 persons to the sq. mile. Chittoor district differs markedly from its eastern and southern neighbours and is a transition belt between the Deccan and the more favoured Karnatic districts. The highest taluk density it records is 495 in the extreme south. Communications and irrigations have their influence here. The pressure of agricultural population is more felt in the eastern and southern parts of the District, (namely, Puttur, Chittoor and Chandragiri taluks) than in the remaining parts due of course mainly to relief.



*Variation in Population**Total Population in the District in*

1901	1911	1921	1931	1941
1,172,886	1,294,423	1,322,664	1,447,103	1,632,000

The table given above shows the growth of population in the district from 1901 to 1941. (The figures for 1901 and 1911 have been adjusted to allow for inter-district transfers, that is to show the population existing at these enumerations in the areas now forming the district. As the district was constituted only in 1911, it is not possible to make such adjustments for censuses earlier than 1901.) The decade 1911 to 1921 showed an increase of only 2% on account of the fact that the district was most affected by the influenza epidemic of 1918 which prevailed in the whole presidency. The increase in population during the decade was also affected by a famine which was caused by the general failure of the south-west monsoon during the period 1918 to 1919. The low increase in population generally in Chittoor district is due to uncertain rainfall, existence of many hills and outcrops, and varying soil in many parts of the district where the precarious aspects of cultivation are most marked. Hence it is not surprising that increase in such an area should be less than in the more favoured regions. The increase during the last decade 1931 to 1941 is 185,000 or 12.79% which is slightly greater than the presidency average of 11.62%. The increase in 1931 over 1921 census was 9.4%.

The statement in the following table shows variation in the taluk figures :—

Taluk	Loss or gain of pop. percent between				
	1901-11	1911-21	1921-31	1911-31	
Chittoor	..	+11.0	+2.1	+8.6	+10.8
Chandragiri	..	+3.4	+4.1	+8.4	+12.8
Palmaner	..	-2.0	+0.7	+18.1	+18.9
Madanapalle	..	+0.4	+2.8	+8.7	+11.7
Vayalpad	..	-1.6	+4.5	+11.2	+16.2
Punganur	..	+10.5	+2.2	+11.8	+14.2
Kalahasti	..	+7.5	+7.9	+8.1	+16.6
Puttur	..	+5.1	+1.6	+7.8	+9.6
Tiruttani	..	+9.1	-0.9	+7.4	+6.5
Kuppam	..	Not available	-7.8	+14.7	+6.9
Whole district	..	+5.6	+2.0	+9.4	

While all the taluks returned during the 20 years (1911-31) an increase in population, Tiruttani has returned an excess of 6.5% only. Puttur also has returned poor excess of 9.6% only. The advancing increase was most marked in Palmaner, Wayalpad and Kalkhasti. The less populous taluks on the west, which border on Mysore returned the higher increase. They were the greatest sufferers from the influenza epidemic in 1911-21. The increase in Kuppam and in Palmaner taluks is to some extent due to a large cattle fair held in that region at census time. It is also due to the fact that a large proportion of labourers belonging to Palmaner Taluk and recruited by the Kolar Gold Fields had at census time returned to their homes on account of unfavourable conditions in the mines.

The Growth of Population in the District

During the decade 1921-31 the birth-rate in the district exceeded that of the presidency average from 1926 onwards. The following table shows that throughout the period there had been an excess of births over deaths and that the births minus deaths was increasing in the district.

Ratio per 1,000 population of

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Births	22.8	32.1	30.9	33.9	33.1	37.4	38.8	37.1	39.0	36.8
Deaths	16.6	20.2	20.8	22.8	22.6	24.4	22.7	27.8	23.0	26.3

Presidency Average

Births	Deaths
34.6	23.9

The death rate in the district is not high as the general health of the district as a whole is good. The following table shows the death rate in the district due to the chief causes:—

Ratio of Deaths per 1,000 of Population

District average for :—

Cholera	..	0.72	Dysentery and	
Small-pox	..	0.13	diarrhoea	.. 2.98
Plague	..	Nil	All other causes	.. 14.08
Fever	..	5.52		
			Total	.. 23.43

Fever accounts for a greater proportion of the total number of deaths in the district.

As regards Emigration of persons from the district, though no reliable figures are available, there is reason to believe that the total number of Emigrants from the district is very little and does not much affect the growth of population in it.

Mother Tongue

The chief languages of the district are Telugu and Tamil, the former being the language of a major portion of the population. About nearly half the population of the Puttur, Tiruttani, Kuppam and Chittoor taluks speak Tamil, while Telugu is spoken mostly in the remaining taluks. Tamil is the prevailing language in the areas bordering on the North Arcot district. The river Palar may be roughly given as the boundary which separates the two languages Tamil and Telugu, though the frontier line of Tamil has passed somewhat to the north of the river and seems extending still further northwards. There is no definite line of separation. Tamil villages are scattered among those of the Telugu people, and those of the latter among the Tamils. Often in the same village Telugu and Tamil castes live side by side, and in such cases it is usually found that the higher classes speak Telugu and the lower Tamil.

Canarese is spoken by nearly 33% of the population in Kuppam taluk which borders the Mysore Plateau and as such gets a mingling of Mysorians among its people. Hindustani is the language of the Mohammedans. The table below shows the distribution as per language.

Percentage in the Total Population of

Taluks	Telugu	Tamil	Kanarese, etc
Chandragiri	100	-	-
Kalahasti	100	-	-
Puttur	54	46	-
Tiruttani	49	50	1
Chittoor	54	46	-
Palmaner	100	-	-
Kuppam	17	50	33
Madanapalle	100	-	-
Punganur	100	-	-
Vayalpād	100	-	-
Whole District	77.4	19.2	3.4

Religion

In the district about 94% of the people are Hindus and 5% are Muslims, while the bulk of the remainder are Christians. The following gives the percentage of the Hindus, Muslims and Christians to the total population in the district as a whole, and in each taluk in particular :—

Percentage to the total population of :—

		Hindus	Muslims	Christians & others.
Whole district	..	94	5	1
Chandragiri	..	94	5	1
Kalahasti	..	97	2.8	0.2
Puttur	..	99	0.7	0.3
Tiruttani	..	98	1.5	0.5
Chittoor	..	95	3	2
Palmaner	..	90	9.9	0.1
Kuppam	..	95.9	4	0.1
Madanapalle	..	88	11	1
Vayalpad	..	87	12.9	0.1
Punganur	..	91	8.9	0.1

Hindus.—The Hindus constitute the bulk of the population. The Brahmins form only 1.4% of the total population. The principal castes other than the Brahmins are the Komatis, Marathis (with caste affix as Rao) and Reddis.

Muslims.—Muslims who contribute only 5% of the total population of the district are more numerous in the Madanapalle, Vayalpad, Palmaner and Punganur taluks than in the other taluks.

Christians.—Christians form a very small minority in the district of about only 1% of the total population. Both the Muslims and the Christians are found more in the towns than in the rural areas.

Literacy

The percentage of Literates among the male population according to the census of 1941⁴ was 14.7 as against the Presidency

4. Figures published in the *Hindu*, dated 22nd Mar. 1941.

average of 20.5%, and that of the literates among the female population was 2.7 as against the presidency average of 5.6%. There is a marked increase in the literacy in the district average during the last decade over the decade of 1921-31, the percentage of literates in 1931 being 9.7 among males and 1 among females.

The following table gives the number of literates among males and females, and among communities, in the district. The high value of literates among Christians is due to the advanced state of women education among them. Education is very backward in the district as compared with other districts.

Taluk	Education in 1931			Literates per	
	No. of literates		Males	1,000 of pop.	
	Males	Females		Females	Males
Chandragiri	10,945	1,292	161	19	
Kalahasti	5,917	480	98	8	
Puttur	5,928	573	59	5	
Tiruttani	9,695	666	96	6	
Chittoor	14,562	2,002	111	15	
Palmaner	3,203	303	105	10	
Kuppam	2,265	217	73	7	
Madanapalle	6,911	869	87	11	
Punganur	6,054	636	96	10	
Vayalpad	5,883	961	77	13	
District Total	71,363	7,999	96	10	
			(average)	(average)	
Hindus	64,846	6,610	94	10	
Muslims	5,051	385	121	10	
Christians	1,455	1,001	272	189	

Life and Occupations of the people

In the district pastoral and agricultural occupations are followed by the major portion of the population. These support 32.9% of the total population (as against 28.2% of the population in the Presidency) as per 1931 census. The following table

shows the classification of the people in the district according to their hereditary occupations:—

Occupation	Pop. supported by the occupation	Percentage of the pop. to the total pop..
Pastoral and Agricultural	476,005	32.9
Industry	50,077	3.5
Trade	25,416	1.8
Domestic Service	300,749	20.8

There is a large increase in the percentage under Domestic service about 20.8%, as against 0.2% in the last decennium owing to the inclusion of females as working dependents under this item. Industrial population comes next in importance.

Among the Agricultural population, the Brahmins are generally the proprietors of lands. The Reddis and Vellalas form the bulk of the cultivating population. Next to Agriculture, weaving is the most important occupation. The Kaikolans are the most numerous of the weaving caste. The Patunulkars a class of immigrant weavers settled in Tirupati carry on silk weaving. The Kammaian or Panchalas living in Tirupati and its neighbourhood work on metal, wood and stone. The Koravans engage themselves in basket and mat making industries. Some of the Muslims are successful and wealthy traders. The "Labbais" occupy themselves in making grass mats and in tanning.

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Chittoor District—A Tri-Lingual Area

By

V. THYAGARAJAN, M.A., L.T., DIP. GEO.

Language is a fascinating study in so polyglot a region as the Madras Presidency. In the administration of Madras 5¹ written languages, excluding English are regularly used, and a sixth—Hindustani—is frequently employed also. The linguistic activities of the presidency do not cease with the six languages. For instance, Tulu is a language of South Kanara, a district whose name belies its prominent linguistic association. The district can be more accurately named Tuluva.

The linguistic frontier has the least regard for district boundaries. A broad allocation of mother-tongues would be: Oriya in the north and north-east, Telugu in the centre, Tamil in the south, and Malayalam in the west, with Kanarese on the Mysore fringes* and Hindustani *passim*.

In the linguistic frontier districts many languages meet. The western parts of Tinnevelly and Coimbatore are the meeting places of Tamil and Malayalam; Chittoor is in a similar manner a junction of 3 languages—Telugu, Tamil and Kanarese. In a district which forms the linguistic frontier we should naturally expect “no man's lands” in which regional influences on languages are more prominent. The Tamil of Chittoor is not the Tamil of the Madras City, and different again from the Tamil of Madura and Tinnevelly. It is not merely a case of corruption or of distance from the approved models of the languages, as other elements enter which are difficult to isolate or assess, but which have relation to racial and other factors.

Again in the linguistic frontier districts it is often difficult to find out the mother-tongue in a number of cases. I noticed that in the case of many the language spoken in the house was quite different from their mother-tongue. For instance, a Telugu gentleman married a woman who knew no Telugu and used Tamil

1. Reference is made to conditions that existed in 1931, as all the statistics in this article refer to that year.

as the language in the house. In such cases a more proper definition of mother-tongue will not be the language spoken at home, but the language which one took in with one's mother's milk.

It often happens that in linguistic border districts races mingle, with the consequence that junction areas occur in language, social customs and religious observances. Many such instances are observable in the Chittoor district.

This district has a population of 1,447,103. The following gives the number of people using the chief languages as their mother-tongue :—

Language	Number of people	Percentage of the total population
Telugu	1,062,529	73·4
Tamil	279,521	19·3
Hindustani	74,553	5·2
Kanarese	20,194	1·4

From the above figures it will be seen that Hindustani is the third important language of the district. Its existence arises mainly from the presence of Muhammadans; who are found not only in this district but throughout the Presidency. Hence, this language is omitted from the present consideration. For the study of Chittoor as the meeting place of 3 languages, I have therefore selected Telugu, Tamil and Kanarese.

From the above table it will be clear that Telugu is the most important language of the district being spoken by nearly three-fourths of the people in it. The northern part of the district is adjacent to the Telugu districts of Anantapur, Cuddapah and Nellore. Hence the Northern taluks of this district—Madanapalle, Punganur, Vayalpad, Chendragiri and Kalahasti²—are definitely Telugu taluks; there is the least admixture of any other tongue; and not even one village in these taluks has 10 per cent of people speaking any other language as their mother-tongue.

The southern part of the district which adjoins the Tamil taluks of North Arcot and Chingleput can therefore be expected to have a greater admixture of Tamil in that area. Hence the taluks of

2. Percentage of Telugus in the following taluks:—Madanapalle—86, Punganur—83, Vayalpad—87, Chendragiri—85, and Kalahasti—87.

Chittoor, Puttur and Tiruttani have a number of villages in which both Telugu and Tamil are prevalent. In this area there are a few villages where all the people speak Telugu; similarly there are a few other villages where the entire population consists of Tamilians. The highest percentage of Tamil speaking population is seen in the Tiruttani taluk, where the prevailing tongue is not Telugu as in the other taluks of this district, but Tamil; for 50 per cent of the people speak Tamil and 49 per cent only Telugu. The reason is obvious, when it is remembered that it is adjoining North Arcot in the south and Chingleput in the east. Tiruttani town has 80 per cent of its inhabitants Tamilians; again in Tiruvalangadu, another populous centre, the Tamil-speaking population is as high as 89 per cent. In the Puttur taluk, big centres like Puttur, Nagari and Narayana-vanam have high percentages of Tamilians, the percentage in Nagari being as high as 72. Chittoor municipality has registered 45 per cent of its inhabitants as having Tamil for their mother tongue. Hence it can be easily concluded that as these taluks adjoin the Tamil districts of North Arcot and Chingleput, and as there are easy means of communication to them from the Tamil districts, there is a greater percentage of Tamil-speaking people in this area.³

The western part of the district is adjoining to the Mysore territory. In fact a portion of this part of the district lies on the Mysore plateau itself. There are roads from Kolar and Bangalore to this part of the district; but the railway line from Bangalore passes through Kuppam taluk only. Hence the western parts of the taluks of Madanapalle, Punganur, Palamaner and Kuppam have a little admixture of Kanarese-speaking people in their population. But except in Kuppam the percentage never reaches 10. It is only in Kuppam that the Kanarese-speaking people are about 20 per cent of the entire population. It is also interesting to note that it is Kuppam that is the real meeting place of the 3 languages; for it contains 48% of its inhabitants Telugus, 30 per cent Tamilians, and 20 per cent Kanarese. We already saw how the railway route, besides roads, from the Mysore territory—the chief region of the Kanarese speaking people—has led to a greater percentage of Kanarese speaking people in Kuppam. Again as this taluk is surrounded on the other sides by the Tamil districts of Salem and

3. Percentage of population speaking the different languages:—

Chittoor	..	Tamil	33,	Telugu	64
Puttur	..	"	31,	"	68
Tiruttani	..	"	50,	"	49

North Arcot, we can reasonably expect a higher percentage of Tamilians in this taluk.

In the linguistic border districts the question of subsidiary languages becomes important. But there is difficulty in deciding what the subsidiary languages are. Mere smatterings and theoretical knowledge should be ruled out. The chief function is to ascertain the effective prevalence of bilingualism, that is, what are the areas in which substantial proportion of the people find it necessary in the ordinary avocations to make regular use of languages other than their mother tongue.

From the general considerations we would expect the use of subsidiary language to be the commonest in the smaller mother-tongue communities and in those most dispersed. We should expect the highest proportions to be among those communities who never command the majority as mother-tongue in any area. We should expect the lowest from regions presenting least admixtures of other communities.

Bearing these considerations in mind we hope to see that in a district like Chittoor, where Telugu is the chief language, only a low percentage of the Telugus will be speaking other languages; while most of the Kanarese and Tamil speaking people, who form the minority in this district, have to use a subsidiary language.

1 Mother-tongue	2 Number of people speaking the mother-tongue	3 Number of people using subsidiary languages	4
			Percentage of 3 in 2.
Telugu	1,062,529	20,488	2
Tamil	279,521	115,097	41
Kanarese	20,194	15,430	77

While Tamil is the chief subsidiary language of the Telugus, Telugu is the chief subsidiary language of the Tamil and Kanarese speaking people. We, therefore, find very little use of subsidiary languages in the northern taluks of this district; but a very high percentage of people have recourse to subsidiary languages in the southern taluks, including Kuppam.

Thus the Chittoor district, situated as it is, among Telugu, Tamil and Kanarese territories partakes the character of the surrounding regions even in the matter of languages.

Public Health and its Relation to Environment

By

P. G. NITYANDAM PILLAI,
District Health Officer, Chittoor.

We have often heard people say that the weather was so bad that the change of climatic conditions brought about the onset of a particular disease, say, a fever, cold, etc. In the western countries, the first topic of conversation for the day would be about the weather. If the weather is good, they would say they were having a glorious weather and so on. All these are too true and this fact of climate and weather affecting the health of people led the pioneers of Preventive Medicine to work at it. It was given to Colonel Russell, the originator of the Department to correlate the relationship of rain-fall, humidity and temperature to the dreadful disease. *viz.*, Cholera and he made certain observations which I shall deal later and we are now fairly in a position to forecast the trend of an epidemic of cholera.

Now, coming to the definition of the subject, by Public Health, I mean the health of the community as a whole and so far as to how the environments affect the community, I shall only confine myself to geographical environments as such rainfall, temperature, humidity, altitude, soil conditions, nearness to sea and so on, that affect our District, *viz.*, the District of Chittoor.

Before I proceed with the subject proper, I have to tell you something of the geography of the District.

The Chittoor District, as you know, is 5,914 square miles in extent. It has a population of 1,447,703. The District is historically important and several pitched battles were fought here. The District proper came into existence only from 1911 or so and prior to that, this was a portion of Quddapah and North Arcot Districts. The District is surrounded on the North by the District of Anantapur, Cuddapah and Nellore and on the South by Salem and North Arcot Districts. The Mysore Province is its neighbour on the West and on the East, we have the Chingleput District. The Plateau of the Mysore Province is contiguous

with the plateau of Palmaner Taluk, Punganur Division and Madanapalli Taluk. Towards the East, the level of the land slopes down to the Taluk of Chandragiri and the divisions of Puttur, Tiruttani and Kalahasti. Roughly we can say that the western Taluks are in the plateau and the Eastern Taluks are plains. A portion of the Eastern Ghats pass through Nellore and Cuddapah; and the famous temple on the hills of Tirupati Tirumalai is on this range of hills. The Palmaner, Madanapalli and Punganur plateau will be about 2500 feet above sea level and hence there is not the existence of a uniformity of temperature and other conditions throughout the District. The temperature in the Western Taluks is higher than in the Eastern Taluks. The Eastern Taluks are more or less hot throughout the year excepting during the rainy season. The average rainfall for the District for the past three years is as follows:—

Rainfall

Year.	Inter-monsoon period (Jan. to May)	South-west monsoon period (June to Sept.)	North-east monsoon period (Oct. to Dec.)
1940	5.32 inches	15.29 inches	17.20 inches
1939	8.18 „	10.33 „	18.19 „
1938	3.99 „	19.84 „	1.71 „

I referred to the work of Colonel Russell on this subject. Chittoor District is in the group of Central Districts, according to his classification; and in all the Central Districts, we get two waves of cholera epidemic, one following the South-West Monsoon and the other following the North-East Monsoon but the winter wave is more prominent than the summer wave.

Due to the rains, there is a rise in the level of sub-soil water and as mostly shallow wells abound in the District, contamination of water supplies in these shallow wells by cholera germs easily starts an epidemic. If a village is situated on the banks of a river and if the villagers resort to the river water for drinking the infection travels down the current affecting all the villages on the way. The optimum temperature and humidity existing about that time is also favourable for the growth and multiplication of

the cholera germs and the disease takes a stronghold, and this calls for the institution of severe anti-cholera measures. Optimum conditions of temperature and humidity favouring growth of cholera germs are found in the Eastern Taluks of the District and so they suffer mostly from this disease, the Western Taluks being free and if at all there is any infection, it does not spread much.

Altitude

I said that the Mysore Plateau adjoins the Taluka of Palmaner, Punganur Division and Madanapalli Taluks. An altitude of over 2000 feet above the sea level and low temperature, are favourable for the spread of Plague. In the Western Taluks, we find these conditions prevailing and so we get Plague there.

There is always Plague in the Mysore bordering villages and the same conditions that prevail there, exist in these plateau and due to the grain trade and human intercourse and travel, Plague has found its way to our District and it has taken root. We are still at it, devising ways and means to eradicate it. Owing to the proximity to Mysore State where there is always the infection and owing to the favourable weather conditions of temperature and so on, Plague has become an endemic disease mostly in the Palmaner Taluk which includes the Venkatagirikota and Kuppam Sub-Divisions.

With good rainfall and with undulating slope all over and thick herbage here and there and with stagnating little streams, we get all conditions favourable for the breeding of mosquitoes, and consequently Malaria. So, the Taluks of Palmaner, Punganur Division, Madanapalle and Vayalpad Taluks are notorious for malaria.

So, to sum up, these Western Taluks show preponderance of glandular infections such as Plague and parasitic infection such as Malaria.

The Taluk of Chandragiri is hilly as the Eastern Ghats pass through here and very probably there is much of calcium in the soil. Here and there layers of mica are found, as I saw in a trial bore for a bore-well. Flourides in combination with calcium as calc. flouride in the soil gets dissolved in the waters of wells and such a flouride water when consumed by the people, brings on a condition called "Fluorosis" wherein the teeth get affected and one sees white or chocolate coloured striations or lines on

them. The fluoride acts as a cumulative poison to the human system and in the course of some years affects a person who has been constantly drinking such a water. The bones and joints are affected and movement becomes impossible. The condition of Flourosis is found highly prevalent in the Districts of Anantapur and Nellore. Studies and researches on this subjects are being continued by the Director, King Institute, Guindy, Madras. All I have to say is that I could see a certain, though not an appreciable, amount of Flourosis in the District.

I give below a comparative statement of mortality from the various diseases in the District and this will give you an idea of the state of Public Health in the District.

Cause of deaths.	No. of deaths recorded in 1940.	Average for 5 years ending 1939.
Cholera	2	478
Small-pox	83	168
Plague	7	25
Fever	7657	8,098
Dysentery and Diarrhoea	3501	3,347
Respiratory Diseases	2336	2,519
Maternal deaths	378	—
All other causes	16317	13,886
TOTAL	30,281	..

We are not free from Leprosy or Tuberculosis as they are universally found all over but I would like to say that Tuberculosis is another disease which is aggravated by weather conditions. If the atmosphere is moist, i.e., more humid as in parts of Malabar District, we get more Tuberculosis.

This brings me on to the Tuberculosis Sanatorium at Arogyavaram, near Madanapalle. Ideal conditions are present here. There is low humidity, less temperature, less heat and with ideal surroundings, like hills on all side and in a basin so to speak, the Sanatorium is situated. The other lovely basin where we have

the privilege of meeting to-day, is the Rishi Valley. This is a lovely spot, where in the midst of healthy and congenial conditions your deliberations are going on.

Taking the District as a whole, although we are not near the sea, we find Chittoor is a lovely District, with its Reserved Forests here and there, with nice roads and pleasant scenery and with a people who have a better sense of cleanliness about them and hence less of diseases as compared with other Districts. The general level of sanitation is good. The ryot is industrious and famine is unknown as prevalent in the bordering District of Anantapur.

**JOURNAL OF
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News and Notes .

We congratulate ourselves upon having completed sixteen years of useful service in the cause of Geography and Geographical studies in this country—thanks to the generous support of our members and subscribers and the co-operation of all concerned.

* * * * *

As a result of the present war we have to mention the scarcity of paper and the very great increase in the cost of production of the journal. These have driven us to the necessity of reducing the size of the journal to some extent as well as the number of blocks in it. Nor have we been able to implement fully certain measures which we have been having under contemplation since its conversion into an All-India Journal. We take this occasion to request our readers to exert themselves a little on its behalf and make it better known and introduce it to their friends so that the number of subscribers may increase and the financial strain felt in these times may be somewhat relieved.

* * * * *

Three meetings of the Association were held during the current quarter. On 18—10—41 Miss H. T. Scudder spoke on "A Brief Study of Vepery." She gave an account of the work of her students by way of direct study in the home region, collecting information regarding shops, factories and occupations by personal enquiries in a part of Vepery in Madras. The lecture was highly appreciated as an interesting experiment, illustrating the method of first hand study in Local Geography

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On 8—11—41 Mr. N. Subrahmanyam delivered a lecture on "The Vale of Kashmir." A reasoned and realistic geographical account of the region was presented, illustrated with typical views taken in his recent visit.

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On 18—12—41 Mr. B. Clutterbuck delivered his Presidential Address to the Association on "Polar Exploration," illustrating it with views. Summaries of these lectures will be published in the next issue of the Journal.

* * * * *

A Summer School of Geography will be conducted by the Association in the Geography Department of the Teachers' College, Saidapet (Madras), in April-May 1942. Details regarding the same can be had from the Secretary of the Association Gopalapuram, Cathedral Post, Madras.

* * * * *

The 12th Geographical Conference of the Association will be held at Vellore during May 1942, along with the Provincial Educational Conference, when papers on various aspects of the Geography of North Arcot District will be read and discussed. Members intending to contribute papers to the Conference are requested to write to the Secretary about it.

* * * * *

The ensuing session of the Indian Science Congress at Baroda in January 1942 will be the last one in which the Geography Section of it will remain separate. As per decision of the General and Executive Committees of the Congress, this Section will henceforward be re-amalgamated with the Geology Section. It remains to be seen whether the Geographers in the country will leave it at that, without a separate common platform and clearing house for their researches. Probably nothing better can be expected, when the subject itself has not yet found its proper place in most Indian Universities and their constituent and affiliated colleges.

* * * * *

Even in the University of Madras, which was the first in India to attempt the introduction of Geography as early as 1920, it is only the Diploma Course that has been functioning for a dozen years, while the Degree Course was to be found in the calendar only till this year. The starting of the latter course now, and that in Queen Mary's College for Women only leads naturally to the question of the University providing early for teaching the Honours Course in the subject, for want of which students wishing to get themselves better qualified have to go outside. Will the University Authorities wake up early and bestir themselves about it.

* * * * *

Of the other Universities that have come into existence in the former Madras University area, Mysore is the only one that has introduced Geography in the Intermediate Course, and is expected to carry it on to the Degree Course—Pass and Honours. Andhra has intermediate Geography in the calendar. Oosmania, Anna-malai and Travancore have apparently not yet bestowed any

thought upon it. Even the present great World War has not served to rub into them the educational, cultural, scientific, economic, political and military importance of the subject.

* * * * *

The Re-organisation of Secondary Education in Madras, which, has been hanging fire for a long time has now come to the forefront. One of the most important proposals in it is the bifurcation of the school course at the end of the fourth form into vocational and pre-university courses. It is highly necessary to see that in this Re-organisation Geography does not miss its proper place and importance in each of the two courses.

* * * * *

"If you in your mind cast your eye over the world map, you will remember that the British Empire falls more or less into two great halves—an Atlantic half consisting of these islands, Canada, West Indies and West Africa, a quadrilateral round the North Atlantic; and a southern half which, from Cape Town to New Zealand, extends in a vast arch of territories and interests round the Indian Ocean. Of that arch the keystone and pivot is India. Into that arch there are two short cuts, two of the world's main strategical gateways as every sailor will tell you. One is the short cut from Europe to the Southern ocean through the Mediterranean and the Suez Canal, which accounts for the presence of the great British Army in the Middle East today. The Straits are the other short cut which leads from the Far East to the Southern Ocean, past the challenge of the great Naval Base of Singapore. India lies midway between these two gateways and is in a better position than any part of the Empire to go to their immediate support and relief in a moment of danger."—L. Amery.

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THE SOUTH INDIAN TEACHER

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Reviews

Longmans' Descriptive Geography: Books I & II in Tamil. (Revised edition). L. D. Stamp, B.A., D.Sc., (London.), F.R.G.S., (Longmans, Green & Co.) 1941. Price As. 11 & 12.

These two text-books of Geography for forms I and II, prepared originally in accordance with the Departmental Syllabus, have now been revised in strict accordance with the recent revision of it. They follow the descriptive method, human activities and physical environment being closely correlated, as enjoined in the general instructions given in that syllabus. The treatment of the subject-matter is clear and simple, and well calculated to rouse the interest and curiosity of the pupils. The volumes are profusely illustrated with suitable maps, diagrams and pictures, several of the photos being original ones taken by the author himself who has travelled widely. Each continent or section closes with a list of choice revision questions, which are both suggestive and stimulating. The clear print, the glazed paper and the fine get-up render the books attractive to the pupils.

Descriptive Geography for Class V: (Tamil and Telugu). By N. Subrahmanyam, M.A., L.T., F.R.G.S., and K. Ramamurti, M.A., L.T., Dip. Geog. (P. Varadachary & Co., Madras). Price As. 8.

Modern Geography has just filtered down to the elementary schools of Madras Presidency in the shape of the new syllabus in Geography recently issued by the Educational Department. Owing to its novelty and its size (due to the plentiful teaching notes contained in it) and to the fact that the teachers have been unacquainted with the modern aspects and developments of Geography, this Syllabus has been looked upon generally as a bugbear, too heavy and too difficult for the pupils. The book under review, which has been prepared in strict accordance with this new syllabus by experts in the subject, treats it not only in a simple way so as to be easily intelligible to the pupils, but also serves incidentally to guide the teacher regarding the scope of the syllabus and the method of treatment. The matter is presented in a clear simple attractive style and illustrated with appropriate pictures, diagrams and maps. The printing and get-up satisfy the requirements of

children's books—bold type, clear print and good paper. (The earlier book for Std. IV in the series available in Tamil and Telugu, was reviewed in the last issue of the Journal).

Indian Information: Vol. 9. No. 80; September 15, 1941. Issued by the Principal Information Officer, Government of India, New Delhi.

- This special number of *Indian Information* on some of India's Great Resources, produced at the instance of the Government of India presents within a short compass a valuable account of the chief material resources and industries of India in a popular form illustrated copiously with excellent pictures. The variety of topics dealt with in this issue include raw materials such as Cotton, Jute and Wool, Vegetable Oils, Mineral Resources, Animal Products, Lac and Resins, Timber, Tobacco, Decorative Veneers and Minor Forest Products; and important industries such as Jute Industry, Cotton Mill Industry, Paper Manufacture, Sugar Industry, Lac Industry, Hides and Skins, Coffee, and Glass Industry. This mine of information is brimming with facts and figures that are useful to the student of Indian Geography and Economics as to the ordinary citizen who desires to get a real idea of the rapidly changing industrial position of the country.

Guide Books for the following Temples in South India (Tamil):—

Trichy Hill Temple, Kamalavalli Temple at Woriur, Tiruvellurai, Tiruvidavendai, Tiruppainjili, Tiruvalangadu, Tiruchendur, Tiruvannamalai, Kovur (in English also) Sri Ranganathaswamy Temple at Srirangam (English). Prepared by the respective Temple Authorities. Price 1 anna each.

The Temples of South India are well-known for their holiness, antiquity, and architectural beauty; and the Hindu Religious Endowment Board, Madras, which has done so much to control and improve them on the administrative and financial side, have recently taken an admirable step by suggesting, guiding and inspiring the executive officers of the Temples in preparing short, cheap, useful Guide Books for them. About a dozen of them are in review here, as per list given above.

These Guide Books have been written in easy and chaste Tamil which could be easily understood by ordinary people. They first touch upon the topography of the locality including physical fea-

tures, and then describe the temples and their various parts and the sub-temples, giving accounts of (a) architectural beauties (sculptures, carvings, paintings and other interesting features); (b) religious myths and traditions as derived from the *puranas* and local accounts; and (c) history of the temples as gathered from old books, records, and epigraphical and other sources. They are generally illustrated with plans and pictures; and references are given to books dealing with the temples and to songs composed by saints and poets in honour of the deity, sometimes with examples of the latter. Two of these pamphlets (those dealing with Sri Ranganathaswamy at Srirangam and Kovur Temple) are brought out in English also. It is desirable that more of them are available in that language, for the benefit of those votaries who do not know Tamil.

The Soil problems of the Madras Presidency: A Partial List of References. Compiled by S. R. Srinivasa Iyengar, L.Ag., Librarian, Agricultural College and Research Institute, Coimbatore, 1941.

This is the 6th of a bibliographical series, prepared by the Librarian, Agricultural College and Research Institute, Coimbatore (in typescript of 25 pages of foolscap size). This valuable List of References is classified under the following heads:—Soil Survey and General Reports; Soil Investigations and Laboratory Studies; Field Instruments and Cultural Operations; Soil Erosion and Soil Conservation Studies; Soil Fertility; Soil Salinity and Alkalinity; Cultural Operations and Cropping; Manurial Problems; Fertilisers; Manures in Relation to Soils and Crops; Land Tenure and Taxation. We have no doubt that this list will be found to be highly useful by research workers in Indian Agriculture, Geology and Geography. It is hoped that this Bibliography will be printed and made available as a bulletin to a wider public.

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Vol. I. No. 8. *Physiographic Features of Cache Creek in Yolo County*. By David M. Durst.

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- Vol. II. No. 4. *Climates of California.* By R. J. Russell.
- Vol. II. No. 5. *The East Bolivian Andes.* By Oscar Schmieder.
- Vol. II. No. 6. *The Cylindrical Equal-Area Projection.* By C. Warren Thornthwaite.
- Vol. II. No. 7. *Landslide Lakes of the Northwestern Great Basin.* By Richard Joel Russell.
- Vol. II. No. 8. *The Pampa: A Natural or Culturally Induced Grass-land?* By Oscar Schmieder.
- Vol. II. No. 10. *Alteration of the Argentine Pampa in the Colonial Period.* By Oscar Schmieder.
- Vol. II. No. 11. *The Land Forms of Surprise Valley Northwestern Great Basin.* By Richard Joel Russell.
- Vol. II. No. 12. *The Historic Geography of Tucuman.* By Oscar Schmieder.
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